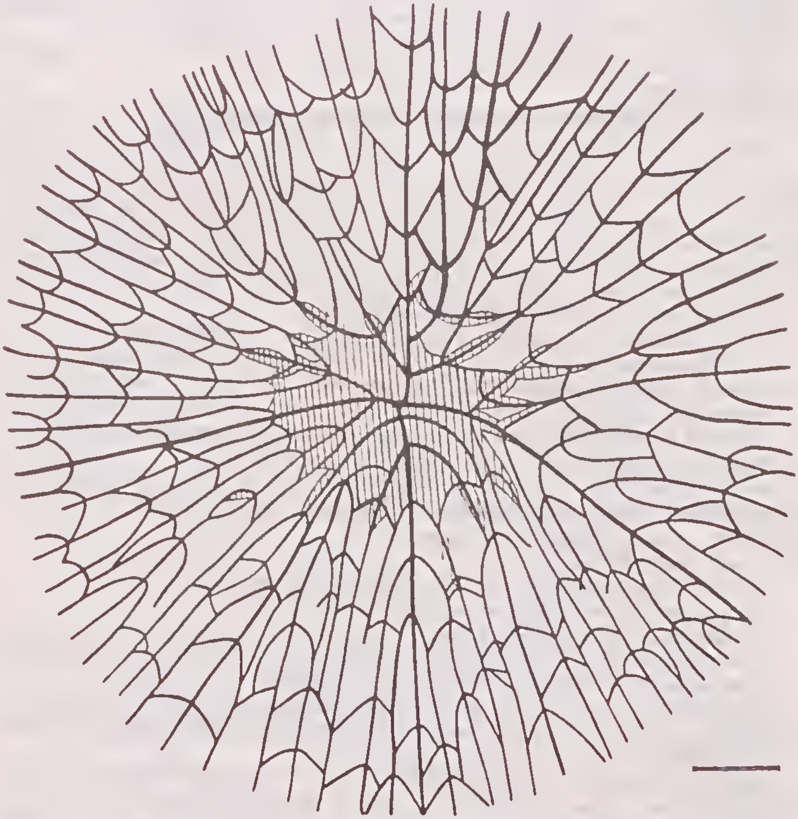
THE FOSSIL COLLECTOR

BULLETIN No 35 SEPTEMBER 1991



Reconstruction of Triaenograptus neglectus based on holotype from Castlemaine, Victoria, of Castlemainian age (Ca1). Scale bar 5 cm. From Memoirs of the Museum of Victoria 52(1). Refer page 14.

Published by
THE FOSSIL COLLECTORS ASSOCIATION OF AUSTRALASIA

ISSN 1037-2997

FOSSIL COLLECTORS' ASSOCIATION OF AUSTRALASIA

SECRETARY
F. C. Holmes, 15 Kenbry Road, Heathmont, Victoria, 3135. (03) 7290447

REPRESENTATIVES

AUSTRALIAN CAPITAL TERRITORY
Mrs. M. Webb, Fairlight Stn., R.M.B. 141, Weston, 2611. (062) 365123

NEW SOUTH WALES
Eric Nowak, 29 Bungalow Rd., Roselands, 2196. (02) 7581728

QUEENSLAND
Ian Sobbe, M/S 422, Clifton, 4361. (076) 973372

SOUTH AUSTRALIA
John Barrie, 1 George Terrace, Coonalpyn, 5265. (085) 711172

TASMANIA
John Fennell, R.S.D. 533, Allport St., Leith, 7315. (004) 282543

VICTORIA
Frank Holmes, 15 Kenbry Rd., Heathmont, 3135. (03) 7290447

WESTERN AUSTRALIA
Mrs. L. Schekkerman, 3 Pascoe St., Karrinyup, 6018. (09) 3416254

CONTENTS

EDITORIAL

In the first three issues of The Fossil Collector, way back in 1980, we included a segment "Question Time" in which we attempted to answer members' questions on topics likely to be of general interest to readers. Although, via the Editorial, we have, repeatedly asked for such questions, there has been a surprising lack of response in the last ten years.

For the first time a specific segment "New Finds" is included, thanks to Colin Chidley (NSW) who has briefly described and illustrated a collection of fructifications recently found in the Blue Mountains. In doing so he also asks if anyone can assist in the identification of a particularly large fructification from Avalon.

It would indeed be pleasing to receive more short articles about members' finds. Even though a specimen has already been identified, it may be of particular importance if it has been found in a location or at a stratigraphic horizon not previously recorded. In my own particular field of interest, echinoid collectors are not only continuing to find new species, but also to extend the known geologic range of species described in the past. There are many areas where no one appears to have carried out any serious study for decades, often not since the turn of the century. With the abysmal lack of funding for field study by professional palaeontologists, dedicated amateurs can be of great assistance in the search for fossils that will extend our knowledge of the past. This has been clearly shown in articles by John Barrie, Steve Eckardt, Lindsay Hatcher, Bob Knezour, Alan Rix, Roy Sharp, Ian Sobbe and many others.

I wonder how many of you watched the recent Discovery programme on ABC television, "The Professor's New Clothes", which dealt with the exposure of scientific fraud reportedly committed by Professor Viswa Jit Gupta from Punjab University, India, and noticed the very unfortunate graphics used at the beginning which showed graptolites and ammonites apparently living, dying and settling to the bottom of the sea together! Even allowing for artistic license they could at least have had the graptolites reaching the bottom first, or was this a deliberate error to indicate scientific fraud? If it was, it certainly was not made clear that these two groups did not co-exist.

Over the last few weeks New Scientist has included a more than usual number of items on fossils. Anyone interested in the topic of extinction should read David Raup's article "Extinction: bad genes or bad luck?" (New Scientist 14th September, 1991). It is an outline of his new book, with the same title, published this month in the USA.

Material for the next issue should be submitted to the editor by 15th December, 1991. AT THE MOMENT WE HAVE ABSOLUTELY NOTHING IN RESERVE!!!

Frank Holmes

FINANCES

Statement of finances as at 15th September, 1991 :

Carried forward from previous year	$2,157.73
Add income 1.3.1991 to 15.9.1991	924.95
	$3,082.68
Less expenditure 1.3.1991 to 15.9.1991	861.15
	$2,221.53
Deduct advance subscriptions	97.10
Balance in hand (excluding cost of this Bulletin)	$2,124.43

IN THE NEWS

RARE FOSSIL STOLEN FROM NATIONAL PARK

Thieves have stolen a 600 million year old Precambrian fossil from the Flinders Ranges National Park according to Neville Pledge, the curator of fossils at the South Australian Museum.

The fossil, an impression of a rare seapen called Charniodiscus arboreus, (a sessile colonial cnidaria related to modern-day corals and jellyfish), was taken when a one tonne slab of quartzite was chipped from a rock face sometime between February and May this year.

Because of the remoteness of the location and the size of the specimen, scientists had left it in place after its discovery in the 1970's. In the interest of security, only a select few knew of its exact whereabouts. However, despite the secrecy and isolation, the theft was discovered by Pledge during a trip to the Flinders Ranges in June this year.

It appears to have been a very calculated theft and would have taken several people highly skilled in their art to remove the rock without shattering the specimen and then carry it about 4 km down a narrow track to the road.

Pledge doubts that the Ediacaran Age fossil will be recovered, particularly as the worldwide fossil blackmarket seems to be expanding, with some museums and private collectors overseas, offering very high prices for rare specimens, presumably without any questions being asked as to whether or not they were obtained legally.

Because of the high prices apparently being offered by unscrupulous collectors (as much as $300,000), Pledge is worried other Flinders Ranges fossils could be stolen.

Report based on an AAP report in The Herald-Sun, Melbourne, 16th July, 1991 and New Scientist, 27th July 1991, p.10.

COULD WESTERN AUSTRALIAN FOSSIL BE THE ANCESTOR OF ALL INSECTS?

A 420 million year old fossil animal that may be ancestral to the world's insects and possibly the first animal to venture on to land, has recently been found by Dr. Ken McNamara, a palaeontologist from the Western Australian Museum.

The fossil, a new genus and species of a group known as the euthycarcinoids was found in a 1,000 metre thick layer of Silurian sandstone in the Murchison River Gorge near Kalbarri in Western Australia.

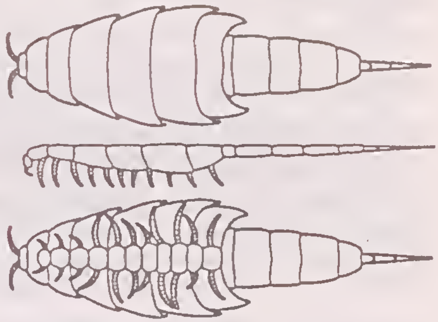
The impression of the underside of the animal was left in sediments laid down by flooding rivers. Not only does the specimen contain impressions of the legs but also clear detail of the leg segments.

The animal which resembles a large segmented cockroach, is about 13 cm long and has a long tail and eleven pairs of legs. Like the eurypterids, giant marine scorpions up to 2 metres long which existed at the same time, it was a predator. As it carries only one pair of legs for each body segment it is classed as part of the arthropod group, referred to as the uniramians (single branch), which includes all modern insects.

Although the oldest recorded insect was found in 375 million year old deposits in New York State; until the Western Australian discovery, the oldest known euthycarcinoids were from Late Carboniferous rocks in France and the U.S.A. that

are 310 million years old. Specimens have also been found in 240 million year old rocks in France and eastern Australia. The euthycarcinoids eventually died out at the end of the Triassic Period about 210 million years ago during a period of mass extinction.

According to Dr. McNamara, the 45 million years between the age of the oldest known insect and the age of the Australian euthycarcinoid raises the possibility that there would have been ample time for insects to have evolved away from the basic euthycarcinoids.



FOSSIL EUTHYCARCINOID

Nigel Trewin, a geologist from the University of Aberdeen has found tracks which he and McNamara believe were made by the animal. The tracks are the same width as the animal and show clear impressions of eleven pairs of legs that were probably made while it was walking out of the water on river flats. Horseshoe-shaped impressions found nearby are thought to be feeding burrows.

Based on the discovery of the tracks and burrows it is considered that the animal was possibly one of the first to explore the land.
Other carnivores, two centipedes and an arachnid, recently found in 410 million year old deposits in Shropshire (UK), along with the fossil euthycarcinoid, support the view that animals were preying on each other rather than living off plants in the Late Silurian.

This raises the question as to whether the generally accepted view, that there was an orderly progression of plants moving to land followed by animals, is correct. Based on the new discovery, McNamara considers the invasion of the land by plants and animals may have occurred simultaneously.

Report based on "Fossil sheds light on genesis of insects" by Julian Cribb, The Australian, 1st August,1991; and "Is Australian fossil the ancestor of all insects?" by Ian Anderson, New Scientist, 17th August,1991, p.13.

TOOTH LINKS PLATYPUS TO SOUTH AMERICA

A 63 million year old tooth found in southern Chile has confirmed that egg-laying mammals related to Australia's platypus and echidna once occurred in South America and Antarctica.

The tooth, an upper-right molar, is the first monotreme fossil found outside Australasia. Scientists consider monotremes to be the most primitive of the three groups of modern mammals.

A Chilean palaeontologist, Professor Rosendo Pascual, of the Museum of Prehistory in Santiago, made the discovery with two students in the Banco Negro fossil deposits of the southern Chilean province of Patagonia.

The owner of the tooth was no platypus or echidna ; the world's two surviving monotremes lack teeth. Professor Pascual told a recent seminar on monotremes in Sydney that it probably came from a plant-eating monotreme that browsed on the leaves of shrubs.

IN THE NEWS (Cont'd)

In his paper, he presented a theory that monotremes did not die out in South America. They may have given rise to a group of strange mammals called edentates, such as sloths, armadillos and giant anteaters.

The world's leading authority on monotremes, Dr.Mervyn Griffiths, said that there was general agreement among Australian experts that the tooth came from a monotreme.

Dr. Griffiths, an honorary research fellow with the CSIRO division of wildlife and ecology in Canberra, said he had been waiting a long time for a monotreme fossil to be found in South America. He expected monotreme fossils would turn up in South Africa.

Professor Pascual and Dr. Michael Archer, of the University of New South Wales, are reported to have compared the Patagonian tooth with monotreme teeth recovered from Australia's richest assemblage of marsupial and monotreme fossils, from Riversleigh Station in Queensland.

It bears some resemblance to a molar from a 25 million year old creature called Obdurodon, a giant relative and possible ancestor of the platypus.

The fact that the South American monotreme is nearly 40 million years older than Obdurodón does not necessarily indicate that monotremes originated in South America and spread to Australia. A fossilised monotreme jaw 110 million years old has been found in Australia.

But the discovery virtually confirms that monotremes once lived in Antarctica. More than 60 million years ago, Australia and South America were part of the supercontinent of Gondwana. Australia formed eastern Gondwana and South America was part of western Gondwana, with Antarctica intervening.

According to a report from AAP, Professor Pascual believes southern Chile has more in common with Australia and Antarctica than with the rest of South America.

Apart from sharing many plants with Australia, southern Chile is home to a diverse group of marsupials, including a possum-like creature called Dromiciops.

Recent research by a Monash University biologist, Dr. Peter TempleSmith, has shown that Dromiciops has sperm that differs from all other South American marsupials, and that is similar to that of Australia's marsupials.

Report by science & technology reporter Graeme O'Neill,
"The Age", Melbourne, 27th August 1991.

RACE TO SAVE DINOSAUR EGGS

In the same issue of New Scientist (17th April, 1991), that reported the rejection of export controls on United Kingdom "works of nature", Sylvia Hughes reported from Paris that the race is on to save Europe's richest site of fossil dinosaur eggs, on the Sainte-Victoire mountain near Aix-en-Provence in southern France. The regional council, which owns a large tract of mountainside where there are hundreds of eggs, has asked the environment ministry to classify the site a geological reserve.

Fossil hunters have plagued the area since the first eggs were discovered 120 years ago. American collectors call the site "Eggs-en-Provence". But the threat to the fossils increased enormously in 1989, when a huge forest fire swept across the mountain, laying bare previously inaccessible areas which had been covered with

thick undergrowth, and exposing the eggs. Nadine Gomez, the Geologist in charge of protecting the site, complains that the deposits of dinosaur eggs are even marked on geological maps "on sale in all bookshops".

Geologists want the eggs left in situ so that they can establish which species of dinosaur used the site and what their laying habits were. Surprisingly, there are scarcely any dinosaur bones on the mountain. This has led to suggestions that female dinosaurs of 70 million years ago came to what was then a low-lying marshy area, specifically to lay their eggs. Floods are thought to have smothered the eggs in sediment.

UNITED KINGDOM "WORKS OF NATURE" EXPORT CONTROLS REJECTED

In an article on "The Earliest Known Reptile" (Bulletin 31, pp.2728), we reported on the problems being faced in the United Kingdom, because of a lack of any legislation that would require the discoverer of a rare or unique "work of nature", such as a fossil or mineral specimen, to delay any sale of the specimen to overseas buyers until British buyers, particularly museums, have the time to raise enough money to match a foreign bid and so keep the specimen in the country. Currently only "works of art" come under the scrutiny of the British Government, who set down the conditions under which an export licence is granted.

William Bown reports in New Scientist (17th August, 1991, p.5) that hopes that fossils and other "works of nature" will be treated in the same way as works of art, when it comes to granting an export licence, have evaporated, following the Department of Trade and Industry's decision not to extend export controls to natural objects.

Peter Lilley, the trade secretary, has written to the Office of Arts and Libraries saying that it would be impossible to grant such a breathing space for natural objects. Controls could not be enforced without checking every lump of coal that leaves the country.

Museum curators are dismayed by the decision. The director of the Museums Association, Mark Taylor, said "To exclude items of natural history is absurd. They are as important to this country's heritage as paintings, machinery or anything else."

In his letter, Lilley says he sympathises with the philosophy behind moves to extend export controls, but has ruled out any change because of the difficulty of monitoring exports. He fears that setting up unenforceable controls would weaken the controls already in place.

This short sighted decision apparently leaves the British Government without an agreed position in European discussions to establish a common set of export regulations for items considered part of a country's heritage.

Luckily "Lizzie the lizard", the earliest known fossil reptile, whose discovery in Scotland by a professional collector initiated the move for stringent controls on the export of rare "works of nature", did eventually remain in the U.K., the Scots having gained time to raise the purchase money.

NEW FINDS

SYDNEY'S WONDERFUL FRUCTIFICATIONS

Colin M. Chidley, P.O. Box 124, Merrylands, N.S.W. 2160.

On the western slopes of the Blue Mountains, within two hours drive from the city of Sydney, the township of Clarence Siding can boast to having the oldest and most beautiful "flowers" in the world.

Fossilised in Triassic times, the "flowers" are in reality the fructifications of a seed-bearing pteridosperm of the family Corystospermaceae. Although fructifications of these "seed-ferns" or Dicroidiums are not uncommon in the Triassic shales in and around the Sydney Basin, the quality and beauty of specimens from Clarence Siding is unsurpassed, being of a beautiful violet to light purple in a creamy white shale.

The following specimens were collected within a few hours, along with large fronds of <u>Dicroidium zuberi</u> from a rock fall that provided easy access to the fossil bearing strata.

Specimen A. <u>Umkomasia</u> sp. A fertile frond consisting of unopened seed bearing cupules, mostly in a tripartite configuration, along a central stem. Size of drawing x 1/2.

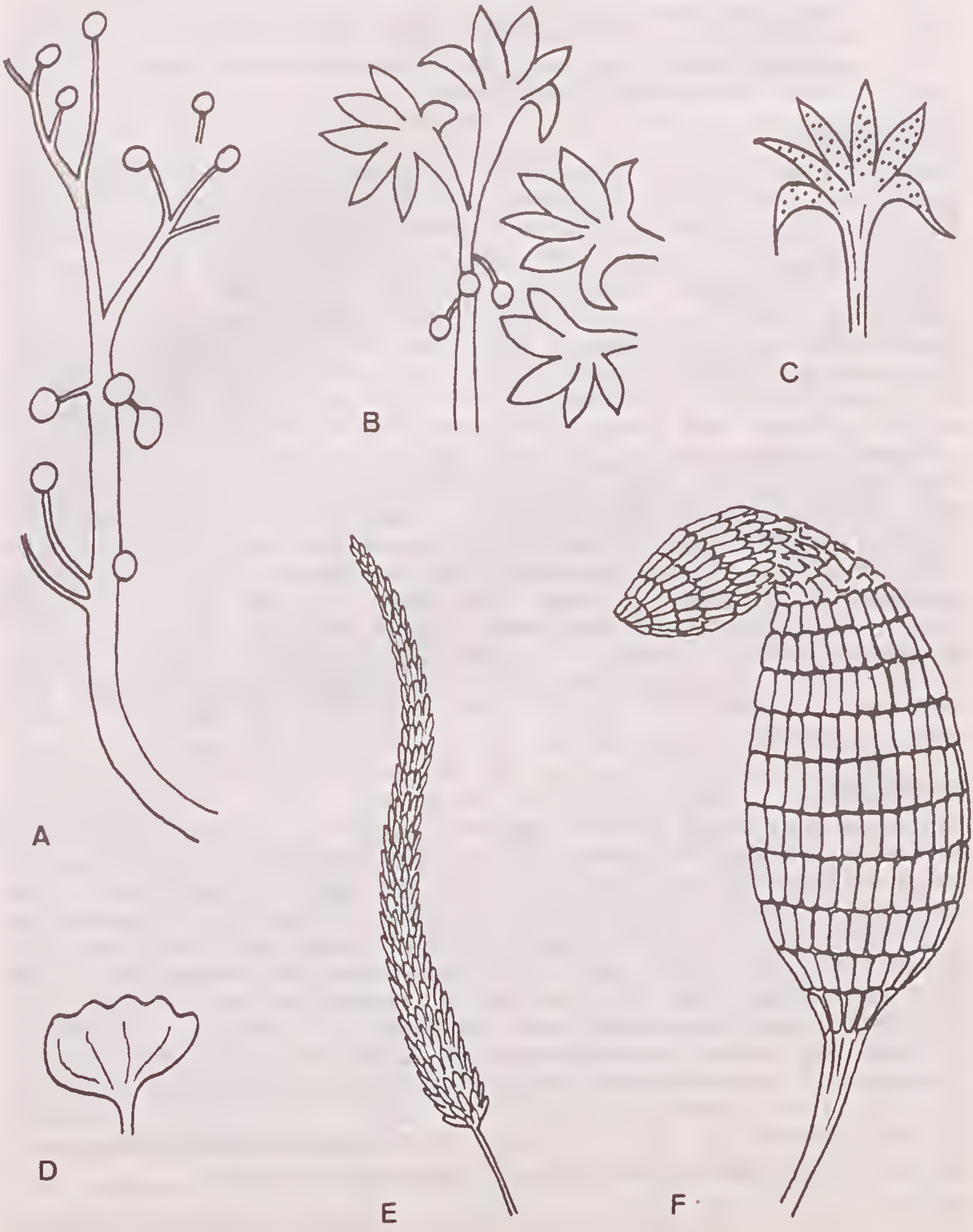
Specimen B. <u>Umkomasia</u> sp. A fertile frond consisting of opened and unopened seed bearing cupules. Size of drawing x 1.

Specimen C. <u>Umkomasia</u> sp. A single opened cupule showing numerous seed impressions. Size of drawing x 1.

Specimen D. A female fructification of unknown affinities. This species has not been identified as yet. Size x 1.

Specimen E. "<u>Pterorrachis</u>" <u>barrealensis</u> A male fructification. Size of drawing x1.

Specimen F. Unidentified fructification. Drawing x 1/2. Although not from the previously mentioned locality, this specimen is included because of its unusual nature. Found at Avalon on the east coast, it is perhaps the largest fructification found to date, and represents a 'one-only' find. Any information on the taxonomy would be greatly appreciated.


A
B
C
D
E
F

THE SCANNING ELECTRON MICROSCOPE AND PALAEONTOLOGY

Robert Jupp, 56 Pandanus Avenue, Coolum Beach, QLD 4573, Australia.
Douglas Harbrow, Department of Dentistry, University of Queensland, QLD 4072, Australia.

INTRODUCTION

Anyone who has seen in scientific publications the beautiful three dimensional images of diatoms and other microfossils, such as fish scales, pollen grains and even bacteria, has experienced the delight of a specialised union of photography and scanning electron microscopy. Scanning electron microscopy (or SEM) has also been central to behavioural and community structure, and histological [Greek; histos = web, logos = see (or study)] studies. For example, Sobbe's (1987) systematic study of the structure and distribution of tooth marks on fossil and recent bones employed SEM. Robson and Young (1990) used SEM techniques in a detailed comparative analysis of the wear marks on the teeth (and hence inferred diet) of the extinct Tasmanian Tiger (Cyanocephalus) and Tasmanian Devil (Sarcophilus). Another fascinating example is that of Martill and Unwin (1989) who showed that the fossilised wing membrane of a pterosaur had an almost identical tissue arrangement to that of bats; they were able to identify muscle tissue, blood vessels and nerves in a delicate structure that existed millions of years ago. Again such insights were delivered by the SEM. So, just what is Scanning Electron Microscopy and how does it work? To answer these questions we must first consider microscopy generally.

MICROSCOPY

The term microscopy [Greek; mikros = small, scopeo = look at] refers to the applied technology of instruments designed specifically to enhance the viewer's visual perception of an object (or specimen). The familiar light microscope does this by gathering light that has passed through, or has been reflected off, the specimen. The light rays (or more correctly waves) are then bent and manipulated by a series of lenses in such a way as to produce an enlarged image just in front of the eye. In short, the specimen under consideration is magnified to enhance detail. Transmission electron microscopy (or TEM) is essentially similar, but electrons instead of light are used. The term transmission is used because as with the light microscope, the electrons pass, or are transmitted, through the specimen being viewed.

At first sight this implied equivalence between light and electrons

seems strange - after all aren't electrons particles, actually tiny "pieces" of electricity, rather than waves like light? The answer is both yes, and no. In the strange sub-atomic world "things" like electrons behave both as particles and waves! But what is important to realise here, is that electrons have wavelengths thousands of times shorter than lightwaves. This becomes significant when the resolving power of a microscope is considered. Resolving power is about seeing **detail**, the ability to distinguish two closely situated points as two points and not as just one. Now it turns out that there is a practical limit to resolving power of any microscope, and it is determined by the wavelength of the waves employed to illuminate the object. As magnification increases, a point is reached when detail ceases to improve. Think of a newspaper photograph, if it is studied with a magnifying glass it gets bigger, but the image breaks into a series of dots - there is a limit to detail, although magnification can increase almost indefinitely.

The shorter wavelength of electrons means more resolving power, that is more detail. Electrons (be they waves or particles) cannot pass through glass lenses (or even air) so the lenses in a transmission electron microsope are magnetic fields because charged particles (now the electrons are behaving as particles!) experience magnetic forces and are deflected. This is done so as to increase the size of the image. Finally the electrons (of the now enlarged image) strike a screen coated with a material that then gives off light - just as happens in a television picture tube.

TEM provides more magnification and detail than light microscopy, but for some applications both are severely limited in terms of their depth of field. The depth of field refers to the portion of the specimen that can be in focus at any moment. With light microscopy and TEM only a very thin slice of the specimen can be in focus, so in effect the images are essentially two dimensional. Another reason for this is the fact that most microscopy requires the illuminating waves to pass **through** the specimen,so the preparation must of necessity be very thin. But what if we want to look at an object in its entirety, not just a slice of it? This is where Scanning Electron Microscopy comes into its own. As the depth of field is very deep, an entire specimen can be in focus thus producing a **three dimensional** image.

SCANNING ELECTRON MICROSCOPY

The Scanning Electron Microscope (we'll get to the term scanning shortly) consists of (i) a source of electrons, (ii) a system

THE SCANNING ELECTRON MICROSCOPE (Cont'd)

of magnetic lenses, (iii) electronic detectors, and (iv) a TV-like display, the first three of which are housed in an evacuated chamber. All electron microscopes must have an internal partial vacuum of at least one ten thousandth of normal atmospheric pressure.

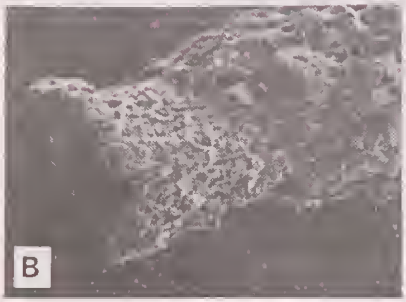
The electron source (called an electron gun) is rather like the element in a light bulb. However, unlike a light bulb, the electrons are induced to "boil off" from the gun and move towards the specimen by a voltage difference (typically in the order of 20,000 volts) between the two. To facilitate this the specimen must either be able to conduct electricity, or be made to do so. The latter is achieved by lightly coating it with an extremely thin film of metal - usually gold.

The magnetic lenses focus the electron beam onto the specimen as a tiny spot. Upon striking the surface of the specimen a myriad of electromagnetic and subatomic interactions occur, one of which is the production of so-called secondary electrons. These secondary electrons are ejected from the surface of the specimen by the primary electrons of the beam from the electron gun, striking the specimen. The number and energy (or velocity) with which the secondary electrons are ejected depends on two factors - the composition of the specimen's surface at that point, and the angle between the surface and the primary electron beam. (Of course the first factor is inconsequential when the specimen has to be metal coated).

The electronic detectors are designed to measure the number and energy of the secondary electrons. Thus the total secondary electron "signal" coming from a particular spot on the specimen will be characteristic of that spot. If the electron beam is then moved to the next spot, it too will have a characteristic signal associated with its secondary electrons. So by **scanning** the electron beam systematically and repeatedly over the whole specimen, the multitude of individual signals which collectively represent the whole specimen are generated.

The TV-like display then compiles an image of the whole specimen by producing points of light on a screen that correspond in intensity and position to the signals coming from the various portions of the specimen.

This process is not unlike the workings of the human eye or television. In each case the waves (light or electron) coming from



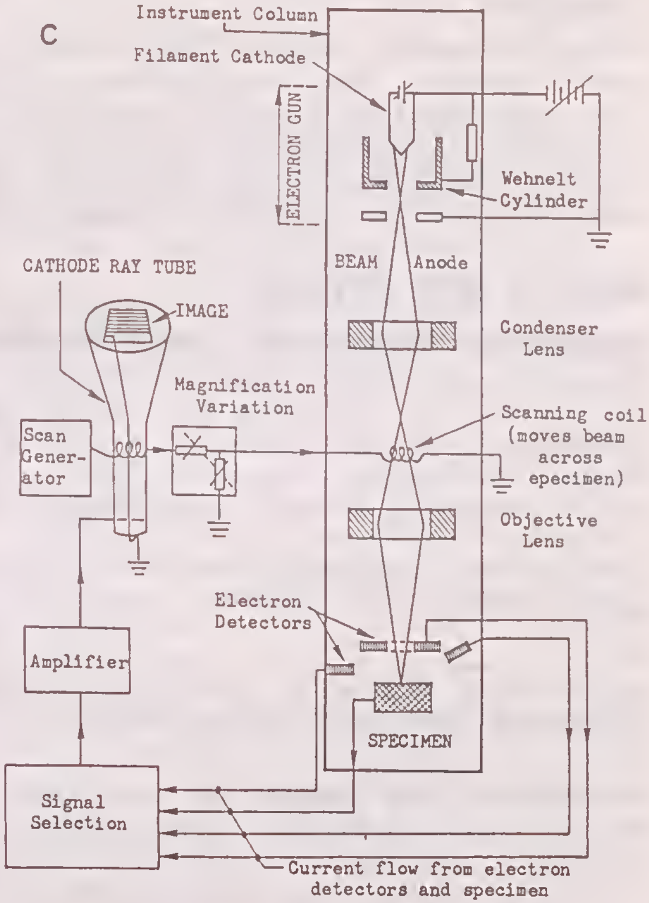


FIGURE 1. A, SEM photograph of an unidentified Lower Devonian cone, x 20; B, SEM photograph of the aperture of a Lower Devonian polyzoan, x 140; and C, schematic outline of SEM construction (modified from Brinkies, 1984).

each part of an object will have certain characteristics (strength and colour for example) which will affect the response of detectors, be they the retina of the eye or the electronic detectors of a TV camera. The detectors convert these wave characteristics into signals, either nerve impulses or (what amounts to the same thing) a fluctuating electric current. Finally, these signals are then converted into an image, either by the brain or by producing flashes of light on a TV type screen.

The final stage (in any form of miscroscopy) is capturing the image photographically. In the case of SEM, a camera is attached to the screen and a slow, single, highly detailed scan which might take 30 or 40 seconds is executed, thus building up the photographic image.

THE SCANNING ELECTRON MICROSCOPE (Cont'd)

CONCLUSION

Although scanning electron microscopes and their infrastructure are very expensive, their contribution to science and technology generally over the last quarter century has been significant and often unexpected. When a high resolution, **three dimensional** image is required, they are without equal. Of all the beneficiaries of this powerful new tool, perhaps the least expected was palaeontology.

BOOKS & BOOK REVIEWS

BENDIGONIAN GRAPTOLITES (HEMICHORDATA) OF VICTORIA by Barrie Rickards and Amanda Chapman. Memoirs of the Museum of Victoria 52 (1), 135 pp. including 156 figs and 35 plates.
Available from the Museum of Victoria (Natural History), Russell Street, Melbourne, Victoria 3000, Australia. Australian price $30.00 including postage and packing.

Sixty graptolite species and subspecies are described mostly from the Bendigonian, but including a few involved in a proposed reclassification of the family Dichograptidae.

This is a **must** for Victorian graptolite collectors, particularly as it redefines the following well known genera: Clonograptus, Tetragraptus (Pendeograptus), Sigmagraptus, Goniograptus and Trichograptus.

A GUIDE TO THE FOSSILS OF THE GINGIN CHALK by K.J. McNamara and D. Friend. Department of Earth and Planetary Sciences, Western Australian Museum, Perth, 1991: 12 pp. Australian price $3.50 including postage and packing (see enclosed order form). Please note cheques to be made payable to the Western Australian Museum.

This 12 page booklet is the first in a series of brief field guides about important fossil localities in Western Australia.

Directed at the amateur collector it briefly describes in two or three lines and illustrates with line drawings the more commonly found macrofossils from the Santonian (Late Cretaceous) Gingin Chalk, a unit of soft crumbly chalk exposed between Gingin and Badginjarra, north of Perth.
The rich marine fauna of which 31 species are illustrated includes among other things, sponges, brachiopods, bivalves, echinoids, ammonites, crustaceans and crinoids.

A short bibliography is included for persons interested in learning more about these Cretaceous fossils.

Further booklets are planned on the Newmarracarra Limestone fossils; fossils from the Fossil Cliff (Permian); and the Late Cretaceous of the Carnarvon Basin.

BOOKS AND BOOK REVIEWS CONTINUED ON PAGE 42

AUSTRALIAN TERTIARY CASSIDULOIDS - AN OVERVIEW (PART 2)

Frank Holmes, 15 Kenbry Road, Heathmont, VICT. 3135.

ABSTRACT
The first part of this article (The Fossil Collector 34, pp.11-27), illustrated and gave details of the five non Echinolampadid Cassiduloids described from the Tertiary marine sediments of southern Australia.

Part 2 includes brief details, and where possible illustrations, of the described species of Australian Tertiary Echinolampadids and a note on the superficial similarity between some fossil Cassiduloids and Neolampadoids.

Much of the information for this part of the article is based on the paper "Tertiary species of Echinolampas (Echinoidea) from southern Australia" by McNamara & Philip (1980).

AUSTRALIAN FOSSIL ECHINOLAMPADIDS

The earliest reference to Echinolampas occurring in Australia can be found in Forbes (1852). However, based on the published sketch, the specimens would appear to have been Cyclaster, rather than Echinolampas. Nevertheless the genus is one of the earliest fossil echinoids described from this continent.

Unlike the five species of Cassisuloids described in the first part of this article, each of which belonged to a different genus, there are seven primary species of the genus Echinolampas recorded from Tertiary sediments in southern Australia, two of which are divided into subspecies (E. posterocrassa & E. gregoryi), and one additional species from western Victoria described as having an affinity with the Tasmanian E. tatei.

Of these ten species & subspecies (listed in Part 1) four were described from a single specimen, namely E. gregoryi gregoryi, E. gregoryi corrugata, E. laubei and E. aff. tatei. An eleventh species of Echinolampas from the Cape Range, N.W. Western Australia (not listed in Part 1) was described by Crespin (1943) as Conoclypus westraliensis.

In addition to described species, Philip (1970) refers to a possible new species from the Abrakurrie Limestone of the Eucla Basin, Western Australia. Echinoids collected from the Middle Miocene of Barrow Island, N.W. Western Australia, also include a species of Echinolampas, which when described may further increase the number of recorded species within Australia.

Echinolampas has a world wide distribution, ranging from Eocene to

AUSTRALIAN TERTIARY ECHINOIDS - AN OVERVIEW (Cont'd)

Recent. However, only one recent form is recorded from Australian waters, the Indian Ocean species Echinolampas ovata (Leske) which occurs along the N.W. coast of Western Australia.

Because of the large number of recorded species of this genus, even within Australia, identification is not always a simple matter, particularly when so many specimens are encrusted with hard calcareous matrix, are badly weathered, or as is often the case, incomplete or otherwise deformed.

Identification is also made more difficult by the variation in profile within an individual species and the gradual change in certain morphological features between juvenile and adult forms.

From personal experience, the problem of identification appears to increase as more and more specimens are collected from previously unrecorded localities where, although the basic composition of a fauna and its age may not vary greatly from a well recorded locality, the palaeoenvironmental conditions have altered quite considerably the frequency with which a particular species occurs.

In many instances specimens seem to contain some features which do not fall neatly within the formally published diagnosis or discussion, yet appear insufficient in variation to justify further speciation. When this occurs in two fairly similar species or subspecies, the amateur worker (and may be even the professional) is left in quite a quandary. Only when there are sufficient specimens from each known locality for a quantitative analysis (using computer techniques) to be carried out, is there a chance of rationalization.

The genus Echinolampas is in itself easy to recognize by the presence of the flosselle (bourrelets & phyllodes) around the peristome (the most common feature of Cassiduloids) and the inframarginal transversely orientated periproct angled to the adoral surface (see profile of E. posterocrassa, Fig. 1), which distinguishes it from the other Australian Tertiary Cassiduloids illustrated in Bulletin 34, page 15 (Fig. 2).

To assist, as far as is possible, in basic identification of Australian Echinolampadids, Table 1 compares the major diagnostic features of seven of the eleven species & subspecies. As previously noted, this is based primarily on descriptions by McNamara & Philip (1980) and McNamara (1987).

Late Eocene specimen from the Tortachilla Limestone, Maslin Bay, South Australia [St Vincent Basin].

Scale bar 1 cm.

FIGURE 1. Posterior (left) & lateral (right) profiles of Echinolampas posterocrassa posterocrassa Gregory, 1890. The posterior recess for the periproct (anus) and the adoral depression for the peristome (mouth) are each shown with a broken line & arrow. The vertical line on the upper surface indicates the centre of the apical system.

Unfortunately it is not possible to provide photographs of all species as some specimens are not immediately available and others lack sufficient tonal contrast to permit satisfactory photographic reproduction in this magazine.

DETAILS AND DISTRIBUTION OF SPECIES

In the following section, details of each species and subspecies are listed under the following headings: HISTORY - including notes on synonymy; RANGE - known geologic time during which species lived; LOCALITIES - including formation and age; DESCRIPTION - prominent features to assist identification [features of seven major species are shown in Table 1]; and SIZE - dimensions of illustrated and type specimens (in millimetres). Note: specimens of Late Eocene species recorded in early collections from Aldinga or Willunga, near Adelaide, South Australia, are deemed to be from the Tortachilla Limestone, or possibly the overlying Blanche Point Transitional Marls, the source of recently collected material.

Echinolampas posterocrassa posterocrassa Gregory, 1890
Gregory, 1890, pp. 483-484, pl. 13/4-6
[Figs 1, 2A & B]

HISTORY: Classification unchanged. Subspecies name added by McNamara & Philip (1980) to distinguish it from E. posterocrassa curtata.

RANGE: Late Eocene (Aldingan).

LOCALITIES: Kingscote Limestone (lower bed), Kingscote, Kangaroo Island, South Australia [St Vincent Basin].

AUSTRALIAN TERTIARY ECHINOIDS - AN OVERVIEW (Cont'd)

A B

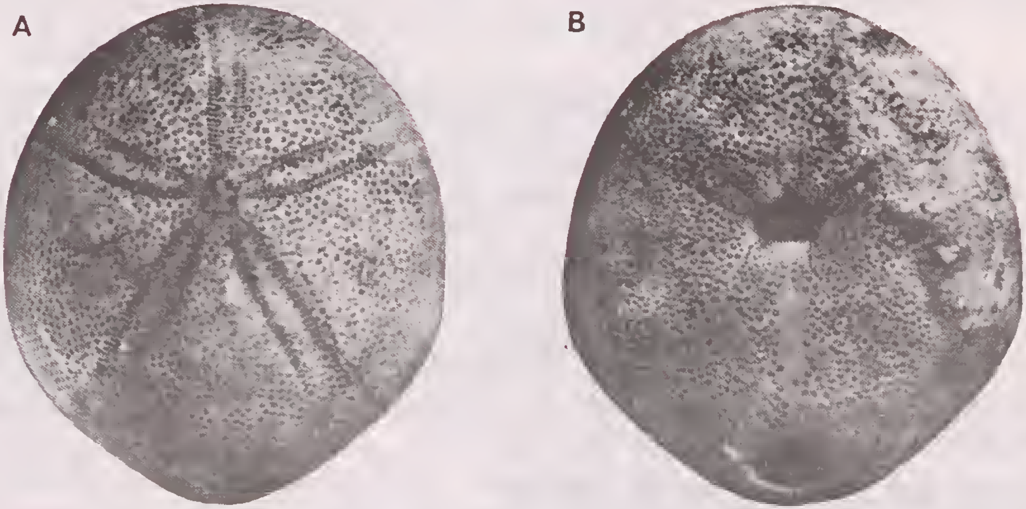


FIGURE 2. Echinolampas posterocrassa posterocrassa Gregory, 1890. A, adapical view of specimen MV P55447, x 1.7; B, adoral view of specimen MV P55450, x 1.4. Both specimens from "Pt Willunga" [Tortachilla Limestone ?], South Australia.

Nanarup Limestone Member of the Werillup Formation, Nanarup, Western Australia [Bremer Basin].

Tortachilla Limestone (Late Eocene), Maslin Bay cliffs, South Australia, [St Vincent Basin].

Wilson Bluff Limestone, Haig Cave, Nullarbor Plain, Western Australia [Eucla Basin]. Note: recorded with Australanthus longianus by Philip (1970) and consequently not referred to a subspecies.

DESCRIPTION: Refer Table 1.

SIZE: Illustrated specimen (adapical surface) - length 38.8, width 33.7, height 22.5 [MV P55447 "Pt Willunga", S.A.]; illust. spec. (adoral surface) - length 47.3, width 43.2, height 26.5 [MV P55450 "Pt Willunga", S.A.].

Holotype - length 43.0, width 36.5, height 21.0 [BM(NH) E3381 "Willunga", S.A.].

Largest specimen recorded by the author - length 64.9, width 58.7, height 40.0 approx. [Kingscote, S.A.].

Echinolampas posterocrassa curtata McNamara & Philip, 1980
McNamara & Philip, 1980, p. 3, pl. 1/7-9
[not illustrated]

HISTORY: Classification unchanged. Subspecies based on material from the Port Willunga Formation [formerly referred to as the Port Vincent Limestone], Yorke Peninsula, South Australia.

RANGE: Late Oligocene - ? Early Miocene

LOCALITIES: Port Willunga Formation (Oligocene - Early Miocene), Adelaide Cement Holdings Quarry, Kleins Point, Yorke Peninsula, S. Aust. [St Vincent Basin]. Note: other specimens from the Late Oligocene members of the Jan Juc Formation at Aireys Inlet, Fishermans Steps (Jan Juc), and Waurn Ponds, Victoria, may be referable to this subspecies. Specimens from the latter locality are however generally more elongated (Fig. 3) and need further study.

FIGURE 2. Echinolampas cf. posterocrassa curtata McNamara & Philip, 1980. Adapical view of specimen from Waurn Ponds, Vict.

DESCRIPTION: Subspecies of E. posterocrassa with short petals, swollen bourrelets and small peristome & periproct.

SIZE: Holotype - length 40.0, width 35.5, height 24.0 [MV P55451]; Paratype - length 44.4, width 39.2, height 26.7 [MV P55452] and length 49.1, width 42.7, height 27.0 [MV P55453]. All from Klein Point, Yorke Peninsula, S. Aust.

Echinolampas tatei Lambert, 1898
Lambert, 1898, p. 165 [not illustrated]
[Fig. 4A & B]

HISTORY: Tate (1893) described and illustrated a new species of echinoid, Conoclypus rostratus from a single specimen found at Table Cape, Tasmania. In 1898, having acquired additional specimens, he transferred the species to the genus Plesiolampas. However, in the same year Lambert placed the species in the genus Echinolampas. As Cotteau (1894) had already erected a species

AUSTRALIAN TERTIARY ECHINOIDS - AN OVERVIEW (Cont'd)

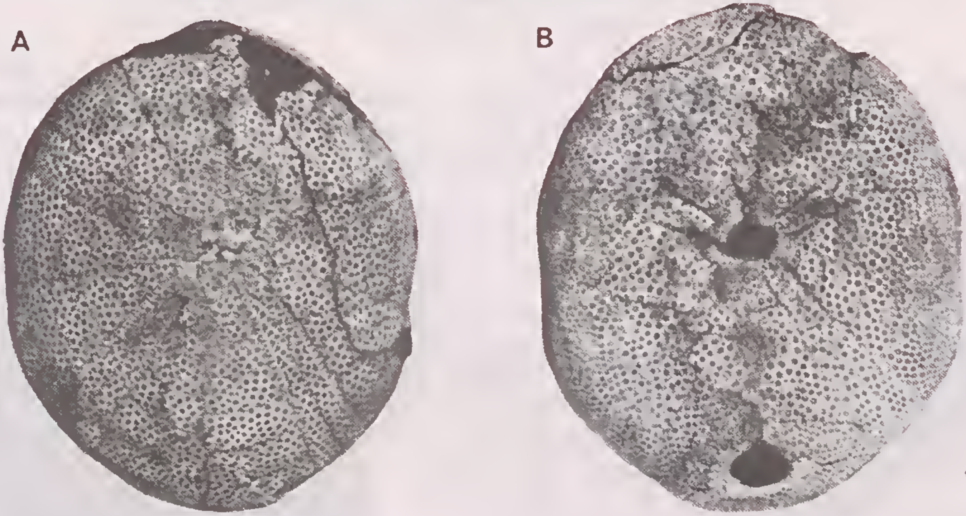


FIGURE 4. Echinolampas tatei Lambert, 1898. A, adapical and B, adoral views of specimen MV P55464, x 1.5, from Fossil Bluff Sandstone, Table Cape, Tasmania.

E. rostratus, Tate's specific name was changed by Lambert to E. tatei. Although subsequent authors continued to use a variety of names, this latter name still stands.

RANGE: Originally referred to as "Eocene" by Tate (1893) and, based on Gill (1957), as Late Oligocene by McNamara & Philip (1980). The age of the beds in which this species occurs are now considered to be Early Miocene (Quilty, 1972).

LOCALITIES: Cape Grim sediments, Cape Grim, N.W. Tasmania [Bass Basin].

Freestone Cove Sandstone ("lower beds") and Fossil Bluff Sandstone ("upper beds"), Table Cape, Tasmania [Bass Basin].

DESCRIPTION: Refer Table 1.

SIZE: Illustrated specimen (approx. dimensions) - length 43.7, width 36.8, height 19.3 [MV P55464].

Holotype - length 57.0, width 54.0, height 24.0 [AUGD T358] Both from Table Cape, Tasmania.

Echinolampas aff. **tatei** Lambert, 1898
McNamara & Philip, 1980, p. 8, pl. 4/1-3
[not illustrated]

Known only from a single specimen [MV P55466] from the Glenelg River at Nelson, Victoria (Early Miocene, Gambier Limestone).

Echinolampas gambierensis Tenison Woods, 1867
Tenison Woods, 1867, p. 1, figs 1a-c.
[Fig. 5A & B]

HISTORY: Classification unchanged.

RANGE: Early Miocene - ? Middle Miocene

LOCALITIES: Gambier Limestone (Early Miocene), Mt Gambier district generally & Naracoorte, South Australia; banks of the Glenelg River, Nelson, Victoria [Otway Basin].

Mannum Formation (Early Miocene), Murray River cliffs between Swan Reach & Mannum, South Australia [Murray Basin].

Also recorded from the Bairnsdale area, Victoria.

DESCRIPTION: Refer Table 1.

SIZE: Illustrated specimen (adapical surface) - length 49.6, width 44.2, height 30.3 [MV P18105, Swan Reach - Mannum, S.A.]; illust. spec. (adoral surface) - length 58.9, width 53.6, height 39.2 [MV P55461, Nelson, Vict.].

Holotype lost, only recorded dimensions - length 44.5, width 38.0.

FIGURE 5. Echinolampas gambierensis Tenison Woods, 1867. A, adapical view of specimen MV P18105, x 1.3, from the Mannum Formation, Swan Hill to Mannum, South Australia; B, adoral view of specimen MV P55461, x 1.1, from the Gambier Limestone, Nelson, Victoria.

AUSTRALIAN TERTIARY ECHINOIDS - AN OVERVIEW (Cont'd)

	E. posterocrassa posterocrassa	*E. tatei*	*E. gambierensis*
TEST (TL = test length)	Outline sub-pentagonal, small individuals low, large indiv's higher	Moderate size, low but conical	Large & conical
APEX	Posterior of AS in small to medium individuals, near coincident in large	Conjunct or slightly posterior of AS & gently rounded	Slightly posterior of AS & gently rounded
APICAL SYSTEM (AS)	Small & low, 1/3 TL from anterior, 1-5 tubercles & ocular plates domed	Close to mid length of test	More than 1/3 TL from anterior (nr mid length in mature spec's) tuberculate & gently domed
MAXIMUM WIDTH	Just posterior of centre	About mid length	Just posterior of centre
ROSTRUM	Well developed	Well developed	Poorly developed
PETALS	Long & lanceolate, not converging distally	Broad, parallel sided for most of length	Broad & confluent distally
PORE PAIRS	Circular & conjugate	Circular & conjugate	Inner circular, outer tear shaped, conjugate
PORIFEROUS TRACTS OF PETALS	Very unequal in length, varies 6-12 pairs	Similar in length	Length slightly unequal, varies 4-7 pairs
INTERPORIFEROUS ZONE	Narrow, poorly tuberculate - average 1 to every other ambulacral plate	Moderately tuberculate	Width five times poriferous tract, raised
ADORAL SURFACE	Pulvinate	Flattened but with impressed ambulacra	Flattened
PERISTOME	Moderately depressed - oval in small specimens, sub-pentagonal in large	Oval & broad	Shallow & pentagonal
BOURRELETS	Poorly developed, swell horizontally with growth	Barely developed	Tumid
PHYLLODES	Average	Fairly broad	Broad
PERIPROCT	Wider than peristome	About equal in width to peristome	Wider than peristome
TUBERCLES	Sparse adorally, broad non tuberculate sagittal tract adorally on interambulacrum 5 between peristome & periproct	Tubercles large & closely spaced	Each ambulacral plate bears 3-4 tubercles. Interambulacrum 5 fully tuberculate adorally
MAXIMUM LENGTH	About 65 mm (Kingscote specimens generally larger than those from Maslin Bay)	Max. recorded 54.1 mm	About 68 mm

TABLE 1. Comparison of morphological features of seven species of the genus Echinolampas

E. morgani	*E. ovulum*	*E. gregori gregori*	*E. laubei*
Small & well rounded, flat adapically	Large, variable height but flattened adapically. More ovate than E. gamb.	Conical, similar test shape to E. tatei	Moderately domed adapically
Almost 2/3 test length (TL) from anterior	Posterior of AS about mid length	Coincident with apical system (AS)	Coincident with apical system (AS)
About 1/3 TL from anterior, non tuber-culate & well domed, ocular plates depressed	More than 1/3 TL from anterior (approx. 35%-40%)	Coincident with apex - (about 40% TL from anterior)	Coincident with apex - (just over 40% TL from anterior). Other details not known
About mid length	50-60% TL from anterior	About mid length	Posterior to centre
Variably developed	Moderately developed	?	?
Short & lanceolate, not converging distally	Very wide & confluent distally	Long, broadening pro-gressively & reaching almost to ambitus	Broad, maximum width mid length, slightly confluent distally
Circular, not conjugate [fewest pore pairs of Australian species]	Pores well separated, outer tear shaped, inner smaller & more circular, conjugate	Outer pores pear shaped, inner small & rounded, weakly conjugate	Outer pores slightly larger than inner, not conjugate
Only slightly unequal in length	Only slightly unequal length	Length slightly unequal, about 4 pairs in amb. 1	Slightly unequal
Narrow, flat, sparsely tuberculate - average 1 to each ambulac'l plate	Flat to gently domed each ambulacral plate bears 4-5 tubercles	Evenly tuberculate. Interambulacra raised above level of ambulacra	Width three times poriferous tract
Pulvinate	Moderately pulvinate	Interambulacra raised as on adapical surface	Gently convex towards ambitus
Deeply sunken, oval	Shallow & pentagonal	Quite deeply sunken, pentagonal	Relatively shallow & pentagonal
Barely developed	Weakly tumid	Weakly developed	Weakly developed
Small	Narrow	Broad	?
High angle to adoral surface (40°-55°), near equal width to peristome	About equal in width to peristome	About equal in width to peristome, inclined almost horizontally	Irregular in shape, alightly wider than long
Each ambulacral plate bears only 1 tubercule Interambulacrum 5 fully tuberculate adorally	Test densely tuberculate, adoral tubercles large Narrow, non-tuberculate sagittal band adorally in interambulacrum 5 bears fine granules	Tubercles closely spaced	Test densely tuberculate
About 50 mm [smallest species from Australian Tertiary]	Max. length not described [Laube's holotype 64 mm]	Holotype 52.1 mm [only recorded specimen]	Holotype 56.5 [only recorded specimen]

from the Tertiary of southern Australia. Information from McNamara and Philip, 1980.

AUSTRALIAN TERTIARY ECHINOIDS - AN OVERVIEW (Cont'd)

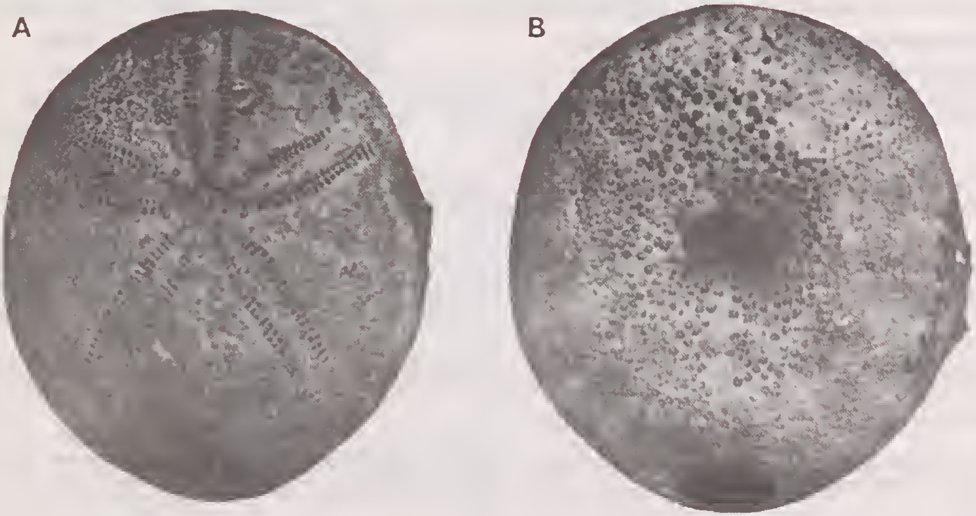


FIGURE 6. Echinolampas morgani Cotteau, 1890. A, adapical view of specimen MV P55454, x 1.9; B, adoral view of specimen MV P55455, x 2.3. Both specimens from the Mannum Formation, Murray River cliffs, South Australia.

Echinolampas morgani Cotteau, 1890
Cotteau, 1890, pp. 546-547, pl. 12/13-15
[Fig. 6A & B]

HISTORY: Classification unchanged

RANGE: Early Miocene

LOCALITIES: Abrakurrie Limestone, Madura Pass, Madura Cave, Firestick Cave, Tommy Graham Cave & Weebubbie Cave, Nullarbor Plain, Western Australia [Eucla Basin].

Gambier Limestone, Mt Gambier district, S.A. & Glenelg River cliffs, N. of Nelson, Victoria [Otway Basin].

Mannum Formation, Murray River cliffs, Blanchetown to Mannum, South Australia [Murray Basin]. Note: specimens found in the Devlin Pound area near Waikerie, S.A. may originate from the Morgan Limestone.

Port Willunga Formation, Giles Point - Wool Bay area Yorke Peninsula, South Australia [St Vincent Basin].

DESCRIPTION: Refer Table 1.

SIZE: Illustrated specimen (adapical surface) - length 34.3,

width 29.2, height 22.1 [MV P55454]; illust. spec. (adoral surface) - length 29.9, width 26.8, height 19.8 [MV P55455]. Both from Murray River cliffs, South Australia.

Holotype - length 30.0, width 27.0, height 20.0 [unnumbered specimen from Mt Gambier in École des Mines, Paris].

Echinolampas ovulum Laube, 1869
Laube, 1869, pp. 191-192 (not illustrated)
[Fig. 7A & B]

HISTORY: Although the original classification has stood the test of time, the similarity of this species to _E. gambierensis_ has caused confusion in the past, Tate (1885) considering _E. ovulum_ synonymous with _E. gambierensis_.

RANGE: Early Miocene

LOCALITIES: Mannum Formation, River Murray cliffs, Blanchetown to Younghusband, S. Aust. [Murray Basin]. Not known elsewhere.

DESCRIPTION: Refer Table 1.

SIZE: Neotype (illustrated specimen) - length 54.0, width 46.1, height 28.5 [MV P55457, Blanchetown, S.A.].

Holotype lost, dimensions not recorded by Laube but given as - length 64.0, width 56.0, height 36.5 by Gregory (1890).

FIGURE 7. _Echinolampas ovulum_ Laube, 1869. A, adapical and B, adoral views of specimen MV P55457, x 1.2, from the Mannum Formation, Blanchetown, South Australia.

AUSTRALIAN TERTIARY ECHINOIDS - AN OVERVIEW (Cont'd)

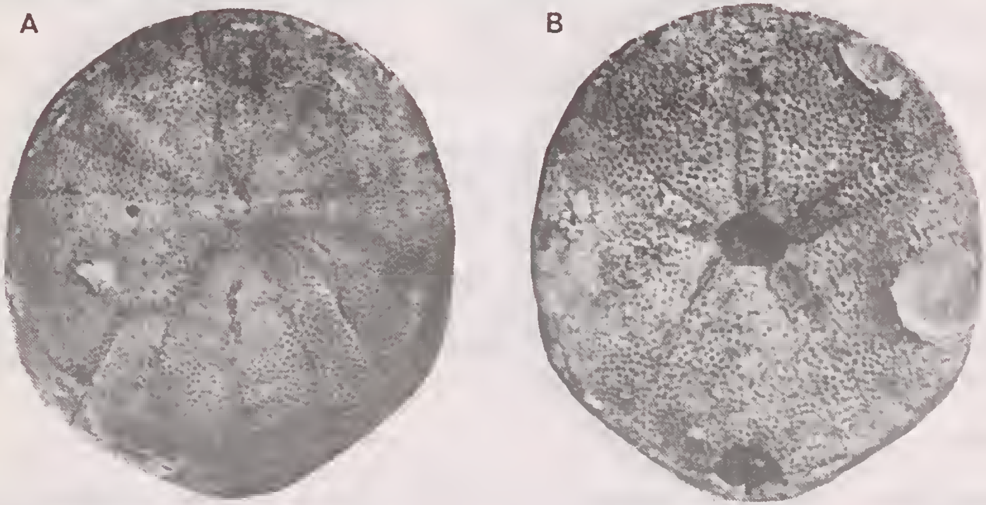


FIGURE 8. Echinolampas gregoryi gregoryi McNamara & Philip, 1980. A, adapical and B, adoral views of specimen MV P18379, x 1.3, from the Gippsland Limestone, "Toorloo Creek", East Gippsland, Victoria.

Echinolampas gregoryi gregoryi McNamara & Philip, 1980
McNamara & Philip, 1980, p. 8, pl. 4/4-6
[Fig. 8A & B]

HISTORY: Recently described species based on a single specimen.

RANGE: Middle Miocene

LOCALITIES: Gippsland Limestone, Bairnsdale Limestone Member ? "Toorloo Creek", East Gippsland, Victoria [Gippsland Basin].

DESCRIPTION: Refer Table 1.
Note: has some morphological features similar to E. tatei.

SIZE: Holotype (illustrated specimen) - length 52.2, width 47.1, height 26.1 [MV P18379].

Echinolampas gregoryi corrugata McNamara & Philip, 1980
McNamara & Philip, 1980, pp. 8 & 10, pl. 4/7-9
[not illustrated]

HISTORY: Recently described subspecies based on a single specimen.

RANGE: Middle Miocene

LOCALITIES: Port Campbell Limestone, Muddy Creek Marl Member, Clifton Bank, Muddy Creek, nr Hamilton, Victoria [Otway Basin].

DESCRIPTION: Differs from E. gregoryi gregoryi by having more swollen interambulacra without median depression, very unequal length ambulacral poriferous tracts (Holotype has a difference of 12 pore pairs in ambulacrum I and 15 in II) and a flatter oral surface with shallow peristome.

SIZE: Holotype - length 68.8, width 60.9, height 43.4 [MV P55477].

Echinolampas laubei McNamara, 1987 [nom. nov.]
McNamara, 1987, pp. 109-110, fig. 1/A-C
[not illustrated]

HISTORY: Recently described species based on a single specimen. Originally named E. duncani McNamara (non Cotteau), 1987. New name given by McNamara, 1989.

RANGE: Middle Miocene

LOCALITIES: Gippsland Limestone, Bairnsdale Limestone Member ? Bairnsdale, Victoria [Gippsland Basin].

DESCRIPTION: Refer Table 1.

SIZE: Holotype - length 56.5, width 49.0, height 32.6 [BM(NH) E1107]

NOTE: A further specimen (MV P128246) probably referable to E. laubei has recently been found in the Museum of Victoria stratigraphic collection. This specimen is also believed to come from Bairnsdale, Victoria.

Echinolampas westraliensis (Crespin, 1943)
Crespin, 1943, pp. 75-77, figs. 1-3
[not illustrated]

HISTORY: Described by Crespin as Conoclypus westraliensis, this species was subsequently referred to the genus Hypsoclypus by Brunnschweiler (1961), a genus since considered to be a synonym of Echinolampas. Although briefly mentioned by McNamara & Philip, it was not redescribed in their 1980 revision of the Tertiary species of Echinolampas.

RANGE: Middle Miocene

AUSTRALIAN TERTIARY ECHINOIDS - AN OVERVIEW (Cont'd)

LOCALITIES: Tulbi Limestone ? Various localities on the east side of the Cape Range, Learmonth, Western Australia [Carnarvon Basin].

DESCRIPTION: Test moderately large, convex to subconical adapically and almost circular in outline. Apical system slightly anterior of centre. Petals long, extending just over 75% distance between apical system and ambitus, wide and slightly convergent distally. Poriferous tracts near equal in length, mildly recessed below level of interporiferous zone and adjacent interambulacra. Pore pairs conjugate, outer pores slot like, inner round. Adoral surface flattened; peristome shallow and pentagonal. Floscelle appears fairly well developed based on illustration of holotype, but is not described in detail by Crespin. Test, including interporiferous tracts, covered with closely spaced small tubercles. Periproct oval, inframarginal & transverse.

SIZE: Holotype - length 74.0, height 49.0 (width not recorded).
Paratype - length 70.5, height 41.5 (width not recorded).

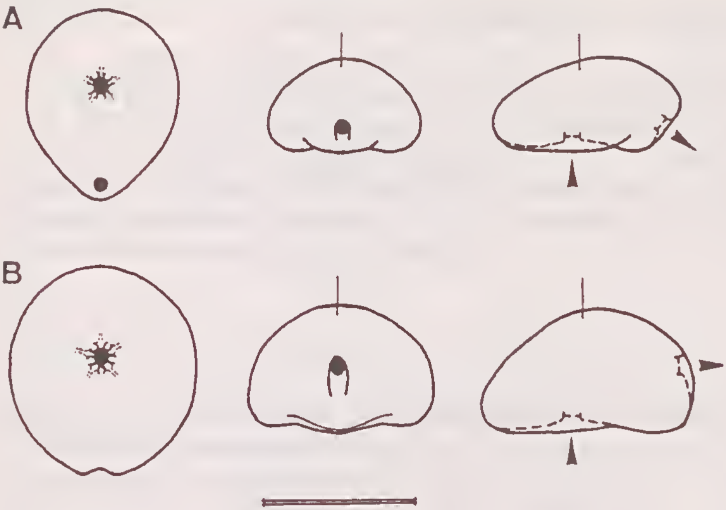
NEOLAMPADOIDS

In 1963, Philip erected two new genera Pisolampas and Notolampas to accommodate two species of previously undescribed fossil Neolampadids from the Tertiary of southern Australia. Although the family Neolampadidae was then considered to be within the Order Cassiduloida (Mortensen, 1948), Philip suggested a new suborder Neolampadina to distinguish this group from the main stream Cassiduloids.

However, Durham and Wagner (1966), in the Treatise on Invertebrate Paleontology (U628), raised this suborder to full order status, thus completing the separation of the family Neolampadidae and its two Australian fossil species from the Cassiduloids.

Both of the above fossil species are small (with a maximum length of about 16 mm.) and although they possess phyllodes and bourrelets they can be easily distinguished from known Australian Cassiduloids, other than Studeria, primarily by the presence of only three genital pores.

Of the two, identification of Pisolampas concinna Philip, 1963, [Fig. 9B] is the more difficult because it has a superficial



A: Notolampas floscules Philip, 1963. Early Miocene (Mannum Formation), Cowirra Swamp Road, nr Mannum, South Australia.

B: Pisolampas concinna Philip, 1963. Kingscote Limestone (Late Eocene - ? Early Oligocene), foreshore cliffs, Kingscote, Kangaroo Island, South Australia.

FIGURE 9. Comparison of the adoral (left), posterior (centre), and lateral (right), profiles of the two Australian fossil Neolampadids. The posterior recess for the periproct (anus) and the adoral depression for the peristome (mouth) are each shown with a broken line and arrow. The vertical line on the upper surface indicates the centre of the apical system. Scale bar 1 cm.

resemblance to Studeria elegans Laube, 1869, both species having a somewhat similar test shape, three genital pores and a periproct (anus) supermarginal at the upper end of a shallow groove. However in P. concinna, adapical ambulacral pores are either rudimentary or missing, compared with the well developed petals of Studeria elegans. Fortuitously their geologic range does not appear to overlap, P. concinna being recorded primarily from the late Eocene Tortachilla Limestone of Maslin Bay and the Kingscote Limestone of Kangaroo Island, South Australia; whereas S. elegans is recorded from the Late Oligocene ? to Middle Miocene of the Murray and Otway Basins.

It is possible that P. concinna does range up into the Oligocene, as it is found in different units of the Kingscote Limestone which is now considered to extend from Late Eocene to Late Oligocene (Milnes et al., 1983). Philip (1970) also refers to the presence of Pisolampas in the Abrakurrie Limestone of the Eucla Basin. No doubt this species also occurs in the Nanarup Limestone of the Bremer Basin.

Notolampas floscules [Fig. 9A], the second of the two small Neolampadids, bears a slight resemblance to Echinolampas in its inframarginal periproct and somewhat posteriorly elongated test.

AUSTRALIAN TERTIARY ECHINOIDS - AN OVERVIEW (Cont'd)

However, adapical ambulacra containing only single pores, the presence of three genital pores and the small size of the test, make it reasonably easy to identify. It was first mentioned by Tate (1891), who considered it to be Pyghorhynchus vassali Wright, a species found in Malta. Specimens are recorded from the Gambier Limestone, N. of Nelson, Victoria; the Mannum Formation near Mannum, South Australia; and the Port Willunga Formation, Wool Bay, South Australia.

ACKNOWLEDGEMENTS

Dr David Holloway for permission to examine and photograph numerous specimens in the Museum of Victoria collections and Neville Pledge, South Australian Museum, for the loan of a specimen of Eurhodia australiae.

GLOSSARY OF TECHNICAL TERMS - Refer Part 1, Bulletin 34.

REFERENCES - Additional to Part 1.

BRUNNSCHWEILER, R. O., 1961. On echinoids in the Tertiary of Western Australia with a description of two new Eocene Fibulariidae. Journal of the Geological Society of Australia 8(2), 159-169.

COTTEAU, G., 1890. Echinides nouveaux ou per connus (9th article). Memoirs de la Societe Zoologique de France 3(5), 537-550, pls 11 & 12.

CRESPIN, I., 1943. The occurrence of the genus Conoclypus in the North-West Division, Western Australia. Journal of the Royal Society of Western Australia 28, 75-77, 1 pl.

FORBES, E., 1852. Our knowledge of Australian rocks as derived from their organic remains. In Jukes et al. "Lectures on Gold for the instruction of migrants about to proceed to Australia". David Bogue, London, 41-67.

MILNES, A. R., LUDBROOK, N. H., LINDSAY, J. M. & COOPER, B. J., 1983. The succession of Cainozoic marine sediments on Kangaroo Island, South Australia. Transactions of the Royal Society of South Australia 107(1), 1-35.

ERRATUM — Bulletin 34, p.13. For E. morgani Cotteau, 1889, read E. morgani Cotteau, 1890 (see reference above).

RECORDS OF VICTORIAN TRILOBITES (CONTINUED)

David J. Holloway, Department of Invertebrate Palaeontology, Museum of Victoria, Melbourne, VICT. 3000, Australia.

The first part of this article (The Fossil Collector 34, p.37-45) listed named species of all trilobites that have been described and figured from Victorian rocks.

To conclude the article, trilobites that have been assigned to a genus but not a species (UNNAMED SPECIES) are listed alphabetically by genus. This is followed by a list of trilobites not assigned to a genus (UNNAMED GENERA), which are arranged by family or subfamily names.

After each generic or family/subfamily name, the entries are similar in arrangement to that previously detailed.

References cover the information source for all sections of the article.

UNNAMED SPECIES

Acanthopyge (Lobopyge) sp.
Holloway & Neil 1982: 150, fig. 6A-K.
Early Devonian, Lochkovian, Mount Ida Formation, Unit 3, Heathcote district.

Acastella sp.
Holloway & Neil, 1982: fig. 5Q-Z.
Early Devonian, Lochkovian, Mount Ida Formation, Unit 3. Heathcote district.

Cheirurus (Cheirurus) sp.
Philip 1962: 228, pl. 35, fig. 5.
Early Devonian, Lochkovian, Boola Formation, Tyers area, Gippsland.

Cheirurus (Crotalocephalus) sp.
Talent 1963: 108, pl. 77, fig. 21.
Early Devonian, Pragian, Tabberabbera Formation, Kilgower Member, Tabberabbera.

Cornuproetus n. sp.
Talent 1963: 108, pl. 76, fig. 11, pl. 77, figs 15-20.
Early Devonian, Pragian, Tabberabbera Formation, Kilgower Member, Tabberabbera.

Flexicalymene sp.
Gill, 1945: 182, pl. 7, fig. 11.
Late Silurian, Ludlow, Kilmore Siltstone, Kilmore.

RECORDS OF VICTORIAN TRILOBITES (Cont'd)

Harpes sp.
Talent 1963: 105, pl. 77, figs 13, 14.
Early Devonian, Pragian, Tabberabbera Formation, Kilgower Member, Tabberabbera.

Harpidella sp. 1
Holloway & Neil 1982: 138, fig. 2N, O.
Early Devonian, Lochkovian, Mount Ida Formation, Unit 3, Heathcote district.

Harpidella sp. 2
Otarion? n. sp. - Talent 1965: 48, pl. 25, fig. 6.
Harpidella sp. 2. - Holloway & Neil 1982: 139.
Early Devonian, Lochkovian, Mount Ida Formation, Unit 3, Heathcote district.

Leonaspis sp.
Holloway & Neil 1982: 152, fig. 6L.
Late Silurian-Early Devonian, Mount Ida Formation, Units 2-3, Heathcote district.

Otarion sp.
Talent 1963: 108, pl. 77, figs 1-12.
Early Devonian, Pragian, Tabberabbera Formation, Kilgower Member, Tabberabbera.

Otarion? n. sp.
Talent 1965: 48, pl. 25, fig. 6 (see Harpidella sp. 2).

Phacops sp.
Gill 1949b: 129, pl. 14, figs 1, 2.
Early Devonian, Pragian, Humevale Formation, Killara.

Phacops (Phacops) n. sp.
Talent 1963: 106, pl. 76, figs 1-8.
Early Devonian, Pragian, Tabberabbera Formation, Kilgower Member, Tabberabbera.

Pilekia sp.
Jell 1985: 78, pl. 32, figs 2-6.
Early Ordovician, Tremadoc, Digger Island Formation, Waratah Bay.

Proetus (Coniproetus) sp.
Holloway & Neil 1982: 137, fig. 2A-M.
Early Devonian, Lochkovian, Mount Ida Formation, Unit 3, Heathcote district.

Reedops sp.
Holloway in Jell & Holloway 1983: 5, fig. 3A-H.
Late Silurian-Early Devonian, Christmas Hills.

cf. Saukia sp.
Chapman 1917: 99, pl. 7, figs 25, 26.
Middle Cambrian, Knowsley East Formation, Heathcote district.

Scutellum sp.
Talent 1963: 105, pl. 74, fig. 4.
Early Devonian, Pragian, Tabberabbera Formation, Kilgower Member, Tabberabbera.

Sthenarocalymene sp. A.
Gravicalymene cf. angustior (Chapman, 1915). - Talent 1965: 49, pl. 26, figs 3-5.
Sthenarocalymene sp. A. - Holloway & Neil 1982: 143, fig. 3A-L.
Late Silurian-Early Devonian, McIvor and Mount Ida Formations, Heathcote district.

Tessalacauda? sp.
Jell 1985: 79, pl. 32, fig. 1.
Early Ordovician, Tremadoc, Digger Island Formation, Waratah Bay.

Trimerus (Dipleura?) sp.
Talent 1965: 49, pl. 26, figs 1, 2, text-fig. 6.
Late Silurian, McIvor Formation, Heathcote district.

UNNAMED GENERA

Dalmanitidae gen. indet. A.
Talent 1965: 50, pl. 25, fig. 2, pl. 27, figs 2-4.
Late Silurian, Ludlow, Dargile Formation, Heathcote district; Kilmore Formation, Kilmore.

Dalmanitidae gen. indet. B.
Talent 1965: 51, pl. 27, fig. 1 (see Odontochile cf. formosa).

Dalmanitidae gen. indet. C.
Talent 1965: 51, pl. 27, figs 6-8 (see Odontochile cf. formosa and Acastella sp.).

Encrinuridae gen. et sp. indet.
Holloway & Neil 1982: 142, fig. 3V, W.
Late Silurian, Mount Ida Formation, Unit 2, Heathcote district.

Homalonotinae gen. et sp. indet. 1.
Trimerus (Dipleura?) sp. - Talent 1965: 49 (partim.), pl. 26, figs 1, 2 (not text-fig. 6).
Homalonotinae gen. et sp. indet. 1. - Holloway & Neil 1982: 145, fig. 4A-H.
Late Silurian-Early Devonian, Lochkovian, Mount Ida Formation, Units 2-3, Heathcote district.

Homalonotinae gen. et sp. indet. 2.
Holloway & Neil 1982: 146, fig. 4I-L.
Late Silurian, Mount Ida Formation, Unit 1, Heathcote district.

RECORDS OF VICTORIAN TRILOBITES (Cont'd)

Homalonotinae gen. et sp. indet. 3.
Holloway & Neil 1982: 146, fig. 4M-R.
Early Devonian, Lochkovian, Mount Ida Formation, Unit 3, Heathcote district.

Hystricuridae gen. et sp. nov.
Jell 1985: 60, pl. 20, figs 4-8.
Early Ordovician, Tremadoc, Digger Island Formation, Waratah Bay.

odontopleurid indet.
Talent 1963: 105, pl. 76, fig. 9.
Early Devonian, Pragian, Tabberabbera Formation, Kilgower Member, Tabberabbera.

odontopleurid trilobite, hypostome
Gill 1949b: 130, pl. 14, fig. 5.
Early Devonian, Pragian, Humevale Formation, Killara.

phacopid trilobite, hypostomes
Gill 1949b: 129, pl. 14, figs 3, 4, 6, 7, 9.
Early Devonian, Pragian, Humevale Formation, Killara.
[Hypostomes figured actually belong to cheirurid trilobites, not phacopids].

Proetidae indet. gen. and sp. A.
Talent 1965: 48, pl. 24, figs 7, 8.
Harpidella sp. - Holloway & Neil 1982: 138.
Late Silurian, McIvor Formation, Heathcote district.

Proetidae indet. gen. and sp. B.
Talent 1965: 48, pl. 25, figs 4, 5 (see Tropidocoryphinae gen. et sp. indet.

Tropidocoryphinae gen. et sp. indet.
Proetidae indet. gen. and sp. B. - Talent 1965: 48, pl. 25, figs 4, 5.
Tropidocoryphinae gen. et sp. indet. - Holloway & Neil 1982: 138, fig. 4S-V.
Late Silurian-Early Devonian, Mount Ida Formation, Units 2-3, Heathcote district.

Tropidocoryphinae? gen. et sp. indet.
Holloway in Jell & Holloway 1983: 4, fig. 3I.
Late Silurian-Early Devonian, Christmas Hills.

REFERENCES

Campbell, K. S. W., 1967. Trilobites of the Henryhouse Formation (Silurian) in Oklahoma. Oklahoma Geological Survey Bulletin 115: 1-68.

Campbell, K. S. W., 1973. A species of the trilobite Dalmanitina (Dalmanitina) from Australia. Geologiska Föreningen i Stockholm Förhandlingar 95: 69-77.

Chapman, F., 1911. New or little-known Victorian fossils in the National Museum. Part 12. On a trilobite fauna of Upper Cambrian age (Olenus series) in NE Gippsland, Victoria. Proceedings of the Royal Society of Victoria 23: 305-323.

Chapman, F., 1912. New or little-known Victorian fossils in the National Museum Part 14. On some Silurian trilobites. Proceedings of the Royal Society of Victoria 24: 293-300, pls 61-63.

Chapman, F., 1915. New or little-known Victorian fossils in the National Museum. Part 18. Some Yeringian trilobites. Proceedings of the Royal Society of Victoria 28: 157-171.

Chapman, F., 1917. The Heathcote fauna. Records of the Geological Survey of Victoria 4: 89-102.

Chatterton, B. D. E., Johnson, B. D. & Campbell, K. S. W., 1979. Silicified Lower Devonian trilobites from New South Wales. Palaeontology 22: 104-111.

Chatterton, B. D. E. & Wright, A. J., 1986. Silicified Early Devonian trilobites from Mudgee, New South Wales. Alcheringa 10: 279-296.

Etheridge, R., 1896. Evidence of the existence of a Cambrian fauna in Victoria. Proceedings of the Royal Society of Victoria 8: 52-64, pl. 1.

Etheridge, R. & Mitchell, J., 1896. The Silurian trilobites of New South Wales, with references to those of other parts of Australia. Part 3. The Phacopidae. Proceedings of the Linnean Society of New South Wales 10: 486-511, pls 38-40.

Gill, E. D., 1938. Yeringian trilobites. Victorian Naturalist 54: 167-171.

Gill, E. D., 1939. The Silurian trilobite Lichas australis. Memoirs of the National Museum of Victoria 11: 140-142, pl. 5.

Gill, E. D., 1942. On the thickness and age of the type Yeringian strata, Lilydale, Victoria. Proceedings of the Royal Society of Victoria 54: 21-52, pls 4-6.

Gill, E. D., 1945. Trilobites of the family Calymenidae from the Palaeozoic rocks of Victoria. Proceedings of the Royal Society of Victoria 56: 171-186, pl. 8.

Gill, E. D., 1947. A new trilobite from the Yeringian (Lower Devonian) rocks of Kinglake, Victoria. Proceedings of the Royal Society of Victoria 59: 8-19.

Gill, E. D., 1948. A gens of dalmanitid trilobites. Journal and Proceedings, Royal Society of New South Wales 82: 16-24.

Gill, E. D., 1949a. Palaeozoology and taxonomy of some Australian homalonotid trilobites. Proceedings of the Royal Society of Victoria 61: 61-73.

Gill, E. D., 1949b. Description and interpretation of some Victorian trilobite hypostomes. Proceedings of the Royal Society of Victoria 61: 123-131.

Gill, E. D., 1951. Revision of McCoy's "Prodromus" types from the Lilydale and Killara districts of Victoria. Proceedings of the Royal Society of Victoria 63: 31-39.

Gill, E. D., 1952. On the age of the bedrock between Melbourne and Lilydale, Victoria. Victorian Naturalist 69: 41-47.

Gregory, J. W., 1901. Cyphaspis spryi, a new species of trilobite from the Silurian of Melbourne. Proceedings of the Royal Society of Victoria 13: 179-182, pl. 22.

Gregory, J. W., 1903. The Heathcotian - a pre-Ordovician series - and its distribution in Victoria. Proceedings of the Royal Society of Victoria 15: 148-175.

RECORDS OF VICTORIAN TRILOBITES (Cont'd)

Holloway, D. J. & Neil, J. V., 1982. Trilobites from the Mount Ida Formation (Late Silurian-Early Devonian), Victoria. Proceedings of the Royal Society of Victoria 94: 133-154.

Jell, P. A., 1985. Tremadoc trilobites of the Digger Island Formation, Waratah Bay, Victoria. Memoirs of the Museum of Victoria 46: 53-88, pls 19-33.

Jell, P. A. & Holloway, D. J., 1983. Devonian and ?Late Silurian palaeontology of the Winneke Reservoir site, Christmas Hills, Victoria. Proceedings of the Royal Society of Victoria 95: 1-21.

McCoy, F., 1876. Prodromus of the Palaeontology of Victoria; or, Figures and Descriptions of the Victorian Organic Remains. Decade 3. Geological Survey of Victoria, 1-40, pls 21-30.

Morris, S. F. & Fortey, R. A., 1985. Catalogue of the Type and Figured Specimens of Trilobita in the British Museum (Natural History). British Museum (Natural History), 183 p., 8 pls.

Öpik, A. A., 1949. A Middle Cambrian trilobite from Victoria - Centropleura neglecta n. sp. Mining and Geological Journal 3 (5): 55-58.

Öpik, A. A., 1953. Lower Silurian fossils from the "Illaenus Band", Heathcote, Victoria. Geological Survey of Victoria Memoir 19: 1-42, pls 1-13.

Philip, G. M., 1962. The palaeontology and stratigraphy of the Siluro-Devonian sediments of the Tyers area, Gippsland, Victoria. Proceedings of the Royal Society of Victoria 75: 123-246.

Shergold, J. H., 1968. On the occurrence of the trilobite genera Acaste and Acastella in Victoria. Proceedings of the Royal Society of Victoria 81: 19-30, pls 3-5.

Strusz, D. L., 1980. The Encrinuridae and related trilobite families, with a description of Silurian species from southeastern Australia. Palaeontographica Abteilung A 168: 1-68, pls 1-6.

Talent, J. A., 1963. The Devonian of the Mitchell and Wentworth Rivers, Geological Survey of Victoria Memoir 24: 1-118, pls 1-78.

Talent, J. A., 1965. The Silurian and Early Devonian faunas of the Heathcote district, Victoria. Geological Survey of Victoria Memoir 26: 1-55, pls 1-27.

Thomas, A. T., 1978. British Wenlock trilobites. Part 1. Monograph of the Paleontographical Society London: 1-56, pls 1-14. Publ. No. 552, part of Vol. 132 for 1978.

Thomas, D. E. & Singleton, O. P., 1957. The Cambrian stratigraphy of Victoria. Bureau of Mineral Resources, Geology and Geophysics Bulletin 49: 149-163.

VandenBerg, A. H. M., Rickards, R. B. & Holloway, D. J., 1984. The Ordovician-Silurian boundary at Darraweit Guim, central Victoria. Alcheringa 8: 1-22.

OVERSEAS COLLECTOR WISHING TO TRADE

JEAN GUY PELLERIN, 2288 DeLorimier, Montreal, Quebec, Canada H2K3X3, wishes to trade North American fossils for Australian specimens. In exchange he can offer Ordovician graptolites & echinodermata from Quebec; Carboniferous fern fossils from Pennsylvania; Cretaceous sharks teeth from N. Carolina; Eocene echinoids from Florida and Miocene sharks teeth from S. Carolina. Members interested in an exchange should write first.

DIG AT DINOSAUR COVE 1990 -1991

REPORT ON OPERATIONS - JANUARY TO MARCH 1991

The FCCA wishes thank Thomas H. Rich, Museum of Victoria and Patricia V. Rich, Earth Sciences Department, Monash University, for providing a copy of their report (10th May, 1991) on the recent work at Dinosaur Cove from which the following is an extract.
For the report on operations from 30th October to 29th November, 1990 refer The Fossil Collector 32/33, January, 1991 (Part 2), pp.67-69.

The original plan for work at Dinosaur Cove during the January - March 1991 period, was to be in three parts. First to excavate and collect the fossils preserved in the floor of the west chamber of the Slippery Rock Site, exposed by the professional miner from Western Mining during November, 1990; second, to excavate the rock pillar next to the concrete pillar which was to have been constructed by the Australian Army also during November; third, to excavate fossils at Dinosaur Cove East (see Fig.2), the original discovery site at Dinosaur Cove which is about 50 metres northwest of the Slippery Rock Site.

As previously reported, the Australian Army Construction Squadron could not participate in the planned operations, resulting in the second part of the 1991 programme having to be abandoned for the time being because of the prerequisite for a concrete pillar.

With the New Year, work began on the first and third phases of the plan for 1991. Lowering the floor of the chamber excavated by Western Mining in November required all of January. Jack hammers were used to break up the rock and a scraper driven by an airpowered winch motor was then employed to drag the rock out of the chamber and tunnels.

Once the scraper could no longer be used because the winch motor failed so completely as to be beyond repair during the field season, attention was turned to construction of the concrete pillar that the Army was to have built the previous November. Initially, it was planned to carry on both the completion of the West Chamber excavation and the construction of the concrete pillar simultaneously. However, construction of the concrete pillar was such a labour intensive procedure that all personnel previously on the chamber excavation project were added to those initially building the concrete pillar. Even with almost the entire crew devoted to construction of the concrete pillar, more than a month and 50 tonnes of concrete were required to complete it, the final pouring taking place at 11:52 p.m. on the night of 2nd March, 1991.

With completion of the concrete pillar, there was only three weeks remaining in the field season so the decision was then taken not to excavate in 1991 the rock pillar (the First Pillar) alongside the newly poured concrete one. As plans currently stand, the collection of fossils from that rock pillar will be a principal objective of the next excavation at Dinosaur Cove.

For the balance of the time remaining, the efforts at the Slippery Rock site were devoted to completing excavation of the floor of the West Chamber started by Western Mining. Although the "skeleton rock", the rock type characteristic of where the two partial dinosaur skeletons previously encountered at the Slippery Rock site, was found in the chamber, it was disappointingly thin and discontinuous in its distribution. Along the southern margin of the chamber the skeleton rock was thick enough to warrant further excavation in that direction in 1993. As was previously

DIG AT DINOSAUR COVE 1990 - 1991 (Cont'd)

the case, fossils in the skeleton rock were few and far between but those found were often exquisitely preserved. Unfortunately, in 1991 no partial skeletons turned up.

Concurrently with the work at the Slippery Rock site, work was going on at a smaller scale at the Dinosaur Cove East site about 50 metres to the northwest. There in January, two detonations of explosives had removed the overburden above about six square metres of fossiliferous rock contiguous with that which produced the first dinosaur bones at Dinosaur Cove.

The primary motivation for this work at Dinosaur Cove East was that based on femora, there are three different hypsilophodontid dinosaurs at Dinosaur Cove. However, only two have been named thus far because only two types of teeth have been recognised. Dinosaur Cove East has all three femoral types and the thought is that with enough work, the third hypsilophodontid dental type might be found, providing the basis for the formal recognition of this aditional hypsilophodontid in the assemblage from Dinosaur Cove.

No such new hypsilophodontid teeth were recognised at Dinosaur Cove during the season. The results, however, were far from unsatisfactory. A variety of small theropods, carnivorous dinosaurs, were found. It was fortunate that near the close of the season, Dr. Philip J. Currie of the Royal Tyrrell Museum of Palaeontology, not only had the opportunity to visit Dinosaur Cove and participate in the work there, but was able to examine a number of specimens collected earlier in the year. An expert on small theropods, he made a preliminary assessment of the material and recognised at a minimum, two different families of these dinosaurs and perhaps as many as four among the small sample of isolated bones recently discovered and prepared.

Because of this tantalising outcome at Dinosaur Cove East, cores were taken in an attempt to determine the shape and extent of the remaining fossiliferous rock body. On this basis, towards the end of the expedition overburden was removed over a ten square metre area of shore platform to a depth of 1.2 metres on average utilising explosives. Exploitation of the now accessible fossiliferous rock immediately below the area excavated will be a priority programme during the next expedition to Dinosaur Cove.

Explosives were also used to expose fossiliferous rock at Dinosaur Cove West, a site last worked in 1985. At that time, all overburden was removed by means of plugs-and-feathers, a system of wedges which is quite effective at splitting rock but which required an undue amount of labour in the circumstances at that site. Abandoned in 1985 because of the great effort required to continue there and the low returns in terms of the quality and quantity of fossil specimens that such work yielded, with the availability of explosives, it is thought that further excavations which are now feasible will likely yield a justifiable return in 1993.

FIGURE 1. Limb bone (femur) of small advanced therapod dinosaur x 1/3, found at Dinosaur Cove, Victoria, 1991.

Colleagues whose work is contributing directly to the reconstruction of the biotic community that existed in southeastern Australia during the early Cretaceous made significant progress in their work during the past year.

Lesley Kool and Michael Cleeland, both of Monash University, prospected and collected a number of fossil vertebrates in the Early Cretaceous Strzelecki Group to the southeast of Melbourne. Their efforts during the past year have substantially augmented the collection of fossil vertebrates from this rock unit, particularly specimens of labyrinthodont amphibians, dozens of which are now known. The quantity and preservation of the labyrinthodont remains together with their position within the Strzelecki Group far from any possible source they might have been reworked from, establishes their age as by far the youngest specimens of this major amphibian group beyond reasonable doubt.

The dinosaur record from the Strzelecki Group was also enhanced. Besides several additional hypsilophodontid bones which will serve to refine the taxonomy of that group, anklylosaurs were added to the list of dinosaurs known from Victoria.

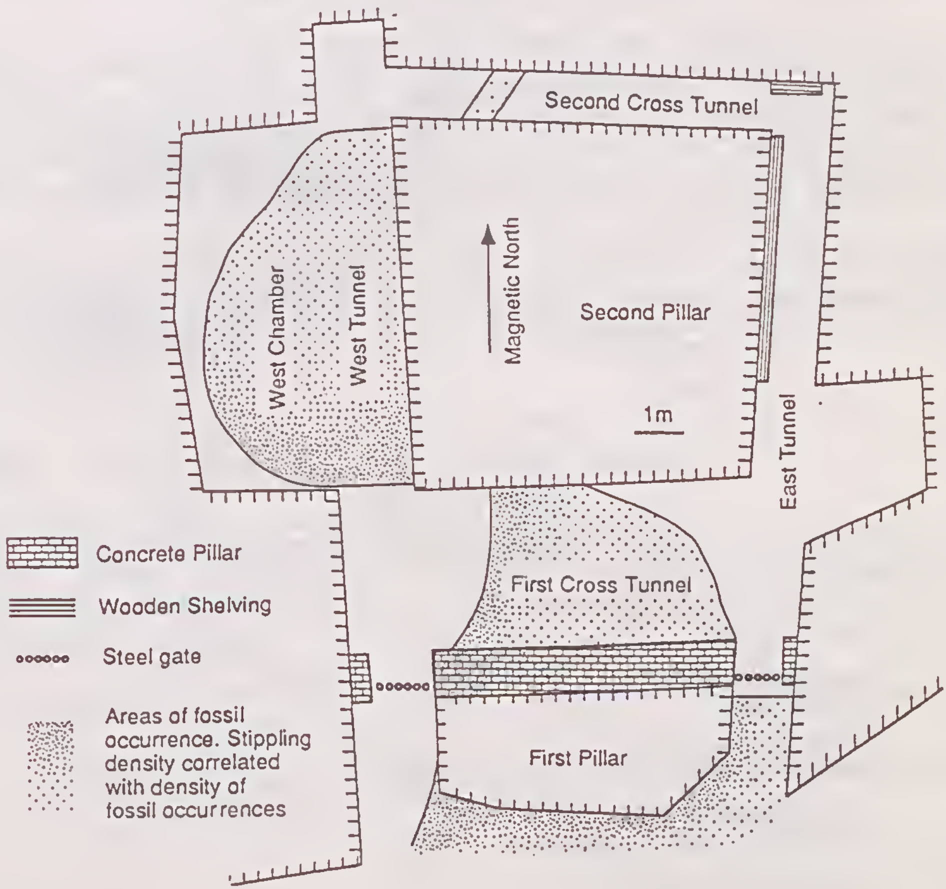


FIGURE 2. Map of Slippery Rock Site, Dinosaur Cove, Victoria, as at 27 March 1991.

DIG AT DINOSAUR COVE 1990 - 1991 (Cont'd)

Recorded from Queensland on the basis of two skeletons of Minmi, ankylosaurs were unknown in southeastern Australia until the discovery of a bone fragment bearing the unique cross section of a rib of that group of dinosaurs. In addition, a partial femur collected earlier from the Strzelecki Group also appears to belong to these animals. Again, an expert on the group in question just happened to be in residence at the right time: Dr.Ralph Molnar of the Queensland Museum who described Minmi, was visiting Melbourne when the diagnostic rib was collected.

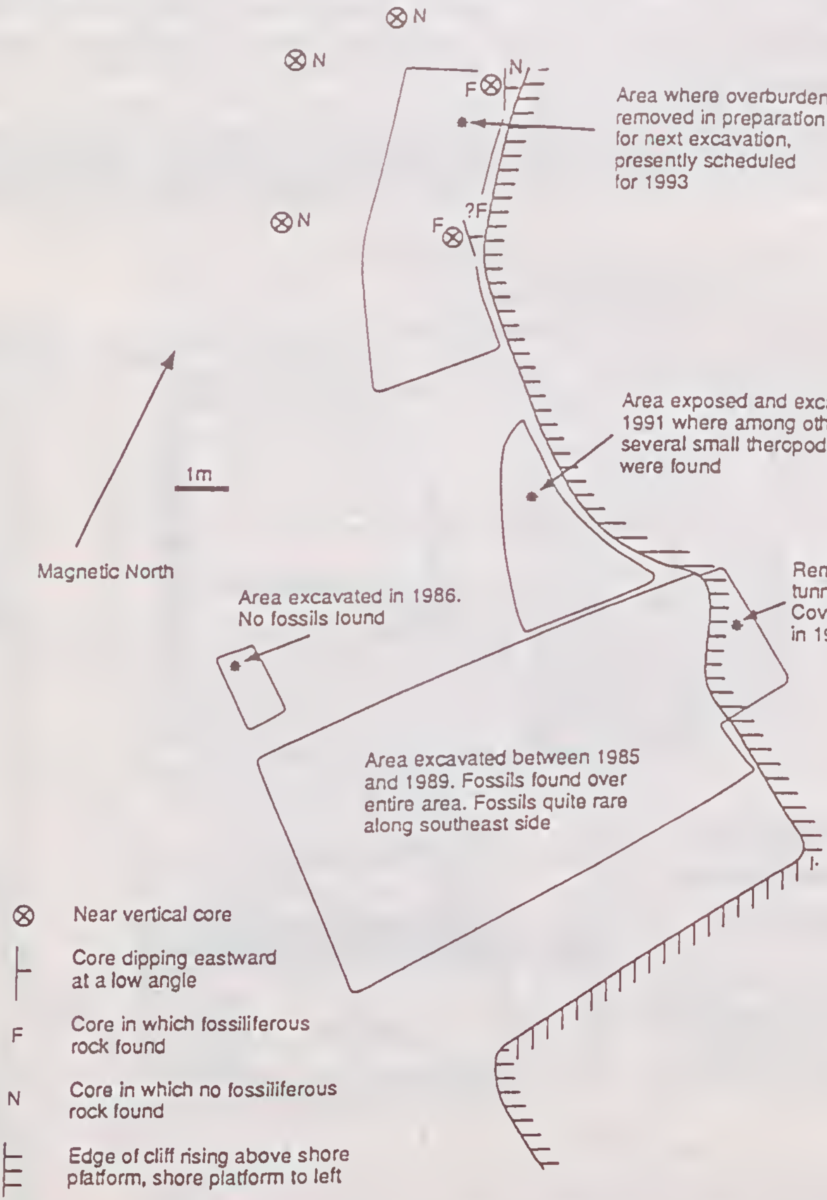


FIGURE 3. Sketch map of Dinosaur Cove East, Victoria, as at 27 March 1991.

Because of these successes in the Strzelecki Group, one month will be devoted to test excavations in those rocks early in 1992 at a number of promising sites. The objectives of this work will be to determine whether or not enough material can be recovered from them by systematic excavation to warrant that approach rather than solely relying on collecting specimens exposed at the surface through natural erosion, the only technique utilised there to date.

A pilot investigation of the Early Cretaceous flora for the purpose of understanding the climatic conditions that then prevailed was made by Robert Spicer, Oxford University, and Judith Totman Parrish, University of Arizona. They were taken to fossil plant localities in both the Strzelecki and Otway Ranges by Jack Douglas, now retired from the Geological Survey of Victoria, who published the first monographs on the Early Cretaceous flora of Victoria. Spicer and Parrish in their three weeks of fieldwork were able to detect substantial differences betwen the polar Cretaceous floras from the North Slope of Alaska where they have spent several seasons, and those of Victoria, suggesting different adaptive strategies were employed to cope with the conditions imposed at high latitudes in the two hemispheres. Based on the results of their laboratory analysis of the specimens collected in the next six months, they plan to design a more extensive field programme to refine the preliminary conclusions this brief visit will warrant.

Andrew Constantine, Monash University, compared and contrasted in detail the sedimentary regimes of the various fossil vertebrate sites in the Strzelecki and Otway groups. Differences in the faunas between these two rock units may in part be owing to differences in the mode of cutting and filling of the channels that prevailed in the two areas. In addition the faunas in the two units are from different parts of their respective rift valleys, those from the Otway Group were buried in flood plain deposits, those from the Strzelecki Group, in alluvial fans.

In the months to come, the rock units he has recognised in outcrop will be dated and palaeoecologically evaluated by Barbara Wagstaff and Jennifer McEwan-Mason, both of Monash University, using palynological techniques, a continuation of their long term effort to provide age control on the Early Cretaceous fossil vertebrate sites of Victoria.

FOSSIL PEDICELLARIAE - A FURTHER NOTE

Subsequent to my article in 'The Fossil Collector' No.34, Dr John Pickett, Dept. of Mineral Resources, N.S.W., has brought to my attention an article on Silurian pedicellariae in N.S.W., by G. M. Philip.

The reference is :

Philip, G. M., 1963. Silurian Echinoid Pedicellariae from New South Wales. Nature Vol. 200, No. 4913, p. 1334.

Ken Bell, Stony Creek, Victoria.

BOOKS AND BOOK REVIEWS CONTINUED FROM PAGE 14

FOSSILS OF THE OXFORD CLAY edited by David M. Martill and John D. Hudson. Palaeontological Association field guide to fossils: Number 4. The Palaeontological Association, London, 1991: 286pp. Price in the United Kingdom £15.00 (excluding postage and Packing).

Over the years, most people devoted to the collection and study of the fossil world, build up a considerable library of palaeontological information ranging from standard text books & scientific journals to detailed works on specific types of fossils and lastly a very varied collection of books, guides and pamphlets describing and illustrating the fossils to be found in a particular part of the world.

Sometimes the content of these latter publications is artificially restricted by the desire of the author, editor or publisher to cover only material from a particular country or state, or what can be even more misleading, bias (usually unintentional) towards one class of fossil because of its abundance in a particular area.

Field guides listing, as far as is practicable, the complete assemblage of fossils known from a specific geological formation are by far the most useful to the collector. Not only do they broaden the horizon of the specialist but also encourage the general collector to recognise and thus retrieve the rare and unusual fossils that may otherwise have gone unnoticed.

"Fossils of the Oxford Clay" is one of four such field guides published by the Palaeontological Association, which falls into the latter category.

Fossil-Lagerstätten (fossil ore layers), a term introduced by Seilacher et al (1971) to describe either exceptional concentrations of fossils (konzentrat) or fossils having an unusual degree of preservation or conservation (konservat) is used quite justifiably to portray both the quantity and quality of the fossils from the Oxford Clay, the argillaceous formation of Callovian to Lower Oxfordian (late Middle to early Late Jurassic) age that stretches across the centre of England in an almost unbroken band from Weymouth in the south to Yorkshire in the north.

Although less than one tenth of the book is devoted to an introductory chapter, it gives a very concise description of the stratigraphy, including details of the ammonite zones and sub zones of the Callovian and Oxfordian Stages; the structure & palaeogeography, facies & palaeoecology; and the fossils groups to be found, their preservation and history of research. Clearly drawn and annotated text figures help to illustrate this basic information so essential to any worthwhile field guide.

The main part of the book is devoted to the description of all known macrofossils as well as some of the more common microfossils.

Following general remarks on each group of fossils, each species listed includes information on its taxonomy; a brief description; remarks on its distribution and frequency of occurrence and in most cases an illustration, either photograph or line drawing. In addition the section covering vertebrate fossils is proceeded by a chapter giving details of the abundance and preservation of the fauna together with notes on collecting strategies. It is interesting to note that even in a small and highly populated country such as England, it is still possible to collect reasonably complete skeletons of marine reptiles such as Ichthyosaurs, Plesiosaurs and crocodiles.

The faunal list for the Oxford Clay (Appendix 1) reveals at a glance the broad diversity of both invertebrate and vertebrate fossils described to date. Among the 304 invertebrates which include a wide range of molluscs and foraminifera as well as brachiopods, arthropods and echinoderms etc., there are an astonishing 78 species of ammonites recorded, nearly all exquisitely illustrated. This fact alone justifies the use of the term Fossil-Lagerstätten to describe the Oxford Clay.

As well as the marine reptiles previously mentioned, the vertebrate fauna contains the remains of over 30 species of fish and last but not least, isolated bones from large terrestrial dinosaurs. However, there are no records of mammalian remains.

Locality information (Appendix 2) and a list of collections of Oxford Clay fossils which can be seen at various Museums in the United Kingdom (Appendix 3) are also included at the end of the book together with over 12 pages of references and a full systematic index.

The high quality of the printing and excellent photography, which one has come to expect from Palaeontological Association publications, set this field guide, and indeed the other three in the series, as a fine example of what can be produced by the close co-operation of research workers with a common interest in a particular fossil rich geological formation.

The only criticism, which is purely a matter of personal taste, is that the layout is conservative, following perhaps too closely (for a field guide) the accepted format for scientific journals.

As a resident antipodean, I only wish such guides could be written on some of Australia's unique fossil deposits.

Other guides in the paperback series "Field guides to fossils":
Fossil plants of the London Clay (No.1) by M.E. Collinson. U.K.price £7.95.
Fossils of the Chalk (No.2) edited by A. B. Smith. U.K.price £11.50.
Zechstein reef fossils and their palaeoecology (No.3). N.Hollingworth and T. Pettigrew. U.K. price £4.95.

Review by Frank Holmes, Heathmont, Victoria.

SEA MONSTERS - Bizarre and unusual creatures from seas of the prehistoric past and present by John Long and Ken McNamara. Published by Western Australian Museum, 1991, 40 pp. [Available from Dr K. McNamara, C/o. Western Australian Museum, Francis Street, Perth, Western Australia 6000. Price $5.00 plus $1.20 postage within WA, $1.40 elsewhere [Note: cheques to be made payable to the Western Australian Museum].

"Sea Monsters" is one of a series of information booklets available from the Western Australian Museum.

Well illustrated with numerous black and white drawings and photographs and written in simple non-technical language, it is an ideal gift for anyone interested in the fascinating marine creatures of the ancient world from the sea serpents of mythology through the "real" monsters of the Palaeozoic, Mesozoic and Tertiary to the giant squids and whales that still live in the sea today.

BOOKS AND BOOK REVIEWS (Cont'd)

Of the fourteen fossil animals or groups covered in the booklet, it is pleasing to note that ten have been recorded from Australian or New Zealand localities.

Also available in the series are : WOLF CREEK CRATERS by K. McNamara, 1982; PINNACLES by K. McNamara, 1983; TEKTITES by K. McNamara and A. Bevan, 1985; and PREHISTORIC MAMMALS OF WESTERN AUSTRALIA by K. McNamara & P. Murray, 1985.

DEVONIAN AND CARBONIFEROUS CORAL STUDIES: A.A.P. Memoir No.10. Edited by P.A.Jell. Published by the Association of Australasian Palaeontologists, Brisbane, 1990, 254 pp. Australian Price $25.00.

Contains the following papers: Lower Carboniferous coral fauna of the Rockhampton Group, east-central Queensland, by Gregory E. Webb; Early Devonian rugose coral fauna from the Shield Creek Formation, Broken River Embayment, north Queensland, by Yu ChangMin and John S. Jell; and, Corals and conodonts of the Late Devonian Mostyn Vale Formation, Keepit, New South Wales, by A.J. Wright, J.W. Pickett, Donna Sewell, John Roberts and T.B.H. Jenkins.

AUSTRALIAN ORDOVICIAN BRACHIOPOD STUDIES: A.A.P. Memoir No.11. Edited by P.A. Jell. Published by the Association of Australasian Palaeontologists, Brisbane, 1991, 177 pp. Australian price $25.00.

Contains two papers: Articulate brachiopods from the Ordovician and Lower Silurian of Tasmania, by John R. Laurie; and, Late Ordovician articulate brachiopods from central New South Wales, by Ian G. Percival.

[**NOTE:** Copies of A.A.P. Memoirs are available from Dr. P.A. Jell, C/o. Queensland Museum, P.O. Box 300, South Brisbane, Q'ld., 4101].

MEMBERS ADVERTISEMENTS FREE OF CHARGE

Members may place personal advertisements, such as an expression of interest in swapping, not exceeding 50 words (approx. 4 lines) free of charge. Details of business advertising rates are available from the Secretary.

SHARON KELLETT, 3/5 Baker Street, Carlingford, N.S.W. 2118, is interested in swapping good quality fossils with fellow members in Australia, as she is no longer able to fossick.

Overseas collector wishing to trade - refer page 36.

NOTE: THE EDITOR, ON BEHALF OF THE ASSOCIATION, ACCEPTS NO RESPONSIBILITY FOR THE STANDARD OR AUTHENTICITY OF ANY MATERIAL EXCHANGED BETWEEN MEMBERS. IT IS SUGGESTED THAT MEMBERS WRITE AND MAKE CONTACT BEFORE SENDING SPECIMENS.